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This Week

Production facilities of the Warner Gear Division of Borg-Warner at Muncie, Ind. are housed in three separate units. Each has a routine of procedure and quality control that is distinctly its own. So unique is the story that Joseph Geschelin found there that the Monthly Production Feature for this issue will be found unusually interesting. See page 141.

Clarence O. Skinner, Executive Secretary of the A.P.E.M. has made a most exhaustive study of production for the 1935-1936 season and tells a most enlightening story of what he learned on page 156.

Sharp Dip Due This Month

Production Drop from Shut-Downs for Inventory And Retooling to Be Cut to a Minimum This Year

By Harold E. Gronseth

August will be a relatively lean month for motor vehicle production. The swift pace maintained by the industry all year finally has been retarded by the change-over period which the industry is now entering. Before the month is ended, some ten or twelve plants will have wound up their 1936 model runs and will be busy tooling up for 1937 production. A half dozen plants cleaned up on outgoing models during the past week. Two more will wind up by the middle of the current week and one large producer is slated to finish on Aug. 20.

Although the industry's August output will show a considerable drop from the July level of upwards of 400,000 units, a fair sized volume will be turned out since the plants in operation throughout all or most of the month will be those of the major producers. The current month's total should compare favorably with the 245,075 cars and trucks turned out in August last year.

Some shriveling of retail sales as result of the recent excessive heat wave is noted in the deliveries reported for the second ten days of July. Seven companies receiving ten-day reports showed a drop of over seven per cent from the first ten days of the month. Normally the second reporting period is better than the first. Sales officials are of the opinion that the drop was due entirely to the ex-

(Turn to page 136, please)

Willys Reorganization Plans

Output of 70,000 cars in 1937 Anticipated; 70% of Present Plant Would Be Used

By G. W. Hibbert

Reorganization of the Willys-Overland Co. into a new $15,000,000 corporation to be known as Willys-Overland Motors, Inc., chartered in Delaware, and scheduled to make 70,000 cars in 1937 with 5000 employees, has been proposed in a plan filed in Federal court in Toledo by Empire Securities, Inc. Judge George P. Hahn has set Aug. 21 as date of hearing on the plan. Deadline for the filing of any objections will be Aug. 15. Empire Securities owns 70 per cent of the first mortgage bonds and approximately 97 per cent of other creditor claims.

The new Willys-Overland Motors, Inc., is capitalized with 350,000 shares of $10 par six per cent cumulative preferred stock and 2,850,000 shares of common stock of a dollar par value. It will occupy 25 of the 67 buildings in the Willys-Overland plant layout or about 3,000,000 sq. ft. out of 6,518,782 sq. ft. owned by the old company.

In the compromise of local real estate tax claims of more than $790,000 for $400,000, to be paid in four equal annual installments, the real estate not used by the new company is allocated to a subsidiary and will become security for the tax lien.

David R. Wilson, trustee under the Section 77-B operations, and for 20 years connected directly and indirectly with the company, will become the president of the new corporation.

Ward M. Canaday, president of the United States Advertising Corp., and leader in the formation of Empire Securities, Inc., will be chairman of the board which will be limited to 12 members.

The plan of capitalization provides for the addition of $3,500,000 new working capital. Studies made for benefit of the court indicate that production of 70,000 cars in 1937, possible on a one-shift, eight-hour day basis, would produce estimated earnings of $1,600,000 after depreciation and other charges and thus enable improvements, new tools, and development expense to be met, as well as support the capital structure of the company.

(Turn to page 162, please)

$2,000,000 More Bonus For Chrysler Employees

In appreciation of the cooperative efforts of the employees of Chrysler Corp. and the successful results of this car model year, it has been decided to distribute an additional $2,000,000 to employees.

Every employee now on the payrolls who was on the payroll during any part of the fourth quarter of 1935 will participate. In the distribution of this fund, length of service of employees will be given recognition.

The minimum amount to any eligible employee will be $25. An extra amount over and above this minimum will be paid for each additional year of service at the rate of one dollar per year, up to and including 10 years. Eligible employees will receive this additional compensation on their first regular pay day falling on or after Aug. 10.

Production Lines

Bonderite Z

Another stride toward effective metal protection — increasing eye appeal—is found in the new Bonderite Z process for treating zinc alloy die cast parts which are to be finished in paint or lacquer. Parker Rust-Proof has produced a simple dip process claimed not only to protect the metal against corrosion but to serve as a paint adherent surface as well. Complete details of the process will be found in a new booklet just off the press. We shall be glad to get you a copy.

Greater Life

P. W. Litchfield, Goodyear Tire president, has just issued a public statement of interest to motorists. Expressed in cold figures, he states in effect that rubber tires now cost less than a quarter of what they did before the great War and last 10 times as long. Those are the bare facts—but what a world of technical achievement in research and manufacturing techniques it encompasses. That part of the story, from a humanized viewpoint, would make mighty interesting reading.

Preferred Number

July *Industrial Standardization* has an important article on the use of preferred numbers as an aid to the selection of standard sizes. The practical application of the theory is of particular value to parts producers who are faced with the problem of an economic variety of sizes to suit the gamut of customers. It applies to such things as the production of a line of steel balls or a line of needle bearings or wire sizes and clip sizes; bolts, studs and nuts. The simple mathematical relation required for the development of a series of preferred numbers is found in a special bulletin which may be obtained from the ASA. —J. G.

Motor Earnings Soar

Chrysler Profits Set New Peak, GM's Net for Second Quarter Over $88,000,000

The two leading publicly owned automobile companies reported record or near record earnings for the June quarter last week.

General Motors Corp. reported June quarter net income of $88,108,372 or $2 a share on the common stock after preferred dividend provision. Except for the like periods of 1928 and 1929 when net income was $2.01 and $2.06 per share, the figures have never been surpassed. The earnings compared with $52,219,467 or $1.17 a share a year ago. Net for the half year was $140,572,546 or $3.17 a share, against $83,729,838 or $1.85 a share in 1935.

A. P. Sloan, Jr., president, said of the company's financial position:

"Cash, United States Government and other marketable securities at June 30, 1936, amounted to $306,635,814 compared with $229,858,180 at June 30, 1935, and $199,435,663 at December 31, 1935. Net working capital at June 30, 1936, amounted to $388,890,622, compared with $340,667,357 at June 30 1935, and $319,961,219 at December 31, 1935.

"Net sales of General Motors Corp., excluding inter-divisional transactions, for the second quarter ended June 30, 1936, amounted to $466,114,437, compared with $343,209,087 for the second quarter of last year. Net sales for the six months ended June 30, 1936, amounted to $807,420,502, compared with $594,883,990 for the corresponding period of 1935."

Chrysler Corp. not only set new peak marks for earnings but also declared the largest single dividend in its history, bringing payments for the year to within 23c. a share of net income. The company reported net profits for the first half of the year of $29,473,736 or $6.83 a share. Indicated income for the June quarter alone, based on a comparison of statements, was $18,020,297 or $4.18 a share. The company declared a dividend of $4 a share following payment of $1.50 and $1 three and six months ago.

Comparison with 1935 statements shows net income for the half year at $18,659,309 or $4.31 a share, while the indicated net income for the June quarter was $9,496,127 or $2.19 a share.

Within a few hours after the earnings announcement, Chrysler Corp. stated that it is to spend $5,000,000 on a new DeSoto plant, using the money to remodel and re-equip the Wyoming works at Detroit and also to enlarge the plant. It will be the first time DeSoto has ever had separate production facilities. K. T. Keller, president of Chrysler, remarked that the DeSoto sales increase of about 60 per cent over last year, under the management of Byron C. Foy, justified the expansion. The new plant is to be among the most modern in the industry, stressing low-cost materials, handling and efficient lighting and working conditions.

The half year's statement also showed the payment of the last portions of the bank loans incurred to finance

(*Turn to page* 163, *please*)

International photo

The U. S. now has a shrine dedicated to St. Christopher, patron of travelers. The shrine was inaugurated at St. Christopher's church at Baldwin, Long Island, on the saint's day, July 25, with appropriate ceremonies.

International Photo

Kaye Don, famous English racing driver, won the 33rd annual gold cup regatta at Lake George last week with Horace Dodge's Impshi. Don is shown in the cockpit as his mechanic casts off.

Will Visit Detroit

After Seeing Plants, Power Delegates Meet in Washington

The third World Power Conference, to be held in Washington, Sept. 7-12, is the first to assemble in the United States and will bring together from 50 nations a gathering estimated at 3000 with between 600 and 700 visitors from abroad, made up of engineers, government and private administrators, financiers, electrical manufacturers, utility executives, economists and sociologists. The main purpose of the conference is to establish a world basis for everything bearing on power. It will provide a medium for open discussion of the role of government and of private industry in the production and distribution of power.

Of particular interest to the automotive industries will be the papers to be presented Sept. 8. The first group will deal with "Organization of Production, Processing and Distribution of Coal and Coal Products." Among papers to be given under this title is one by Doctor Koppenberg and Mr. Schlatmann on "The Industrial Production of Motor Fuels from Coal in Germany." Isador Lubin of the Department of Labor and a representative of the National Coal Association also will contribute papers under this title.

Another group will deal with the subject of "Production and Distribution of Petroleum and its Products." Among those who are to present papers on this subject are Myron S. Watkins, New York University; E. L. deGolyer, president, Felmont Corp., Houston, Tex.; J. Noel Robinson, vice-president, Tidewater Oil Co., New York; R. E. Hardwicke, Fort Worth, Tex., and Joseph E. Pogue, consulting engineer.

Because it is the country's greatest automotive center, Detroit has been selected as one of the centers to be visited by a technical study tour. The automotive plants in and near Detroit use vast quantities of electricity, gas, oil, coal and ore, so that a study of their methods is of vital importance. Delegates will visit many plants in Detroit, including the Ford factory and General Motors laboratories. Literature sent out by the conference points out that the famous Ford automobile plant, aside from its interest as the largest single industrial plant in the world, is a gigantic industrial power development. In the General Motors laboratories, some 450 research workers are engaged in a wide range of scientific studies bearing on automobiles, electrical equipment, radios, etc.

Group tour No. 1, made up of parties on coal, oil, gas and internal combustion engines, will begin in New York Aug. 31 and end in Washington Sept. 6. Detroit will be visited Sept. 1, Cleveland, Sept. 2 and Pittsburgh, Sept. 3, 4 and 5.

Just Among Ourselves

Quiet Autumn For Labor Front

Both labor officials and automobile executives in the Detroit area seem pretty well convinced that there will not be any serious labor trouble in the automobile industry this year.

Contributing to this view are several things of a concrete nature: First, the United Automobile Workers are out to raise a "War Chest" of $250,000, of which the locals are responsible for $75,000. The U.A.W., in its official organ notes that the gross sum represents about $2 per capita, which indicates a dues-paying membership of 125,000 workers.

We doubt if there are that many active members on the rolls of the U.A.W., which if true, would increase the per capita assessment to more than $2. The assessment is in addition to regular dues, and does not seem to be pouring into Union headquarters.

Until the Union is financed adequately, it does not seem likely that it will feel in a position to risk importunate demands—which might force it into taking expensive action.

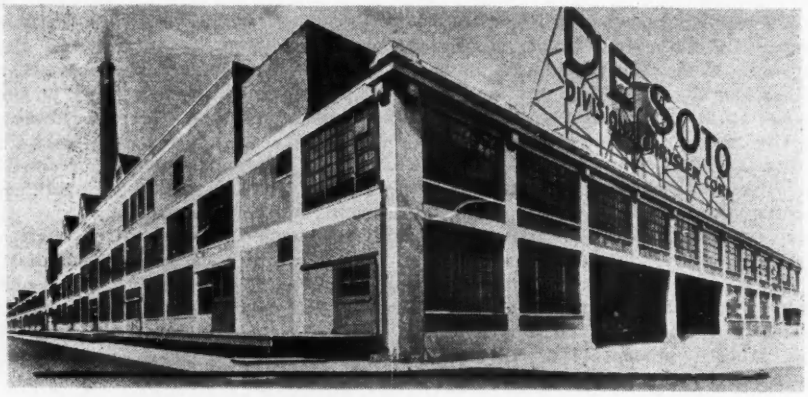
Second, promise of a wage increase Sept. 1 for workers at Bendix, with several other concessions for the U.A.W. averted a threatening strike in a plant which supplies something to every automobile manufacturer, and which is considered a key plant in the labor situation. **It isn't likely that anything will break at Bendix with an agreement affecting Autumn production already signed.**

The U.A.W. will be busy for a while with the details of consolidation. Almost every automobile union of any size is now in the fold, except the Mechanic's Education Society of America. But the temperament of Matthew Smith, the M.E.S.A. chief, is not given to compromise, and it may be some time before the U.A.W. is able to present a truly united front.

Rumor Moves Some Big Corporations

DuPont has begun construction of two 13-story additions to its office building in Wilmington, Del. Ordinarily that would not be a matter for specific comment in these pages, but the beginning of construction activity on the buildings was the signal for a flock of rumors to rise and spread their wings: that General Motors, in which DuPont interests have a stock share of about 23 per cent, would move its headquarters from New York to Wilmington; that Firestone would do the same, and that several other companies of automotive interest were seeking Wilmington locations.

There seems to be little basis for fact in such rumors. It is true that DuPont has been concentrating in Wilmington the offices of various subsidiary companies, and that many Delaware corporations have in the past few years decided to make Wilmington actual rather than nominal headquarters, but it is not likely that big automotive companies would care to break the ties which bind them to Detroit and New York. They won't admit it, anyhow. —H. H.



De Soto's new $5,000,000 manufacturing and assembly plant. It occupies a 40-acre plot at Wyoming and McGraw in the southwest section of Detroit.

Kenosha Fetes Nash Anniversary

Entire City Stops Work to Celebrate the Founding of Motor Enterprise 20 Years Ago

By Harold E. Gronseth

Commemorating the 20th anniversary of the founding of the Nash Motors Co., the city of Kenosha in festive array paid tribute last Wednesday to Charles W. Nash, founder of the company, and E. H. McCarty, its president. A civic observance unparalleled in the history of the community was staged by the Kenosha Chamber of Commerce. Business was suspended in the afternoon as citizens joined in the celebration, featured by a parade of cars presenting each year since 1916, including a surviving World War army "Quad" truck. Climaxing the day was a banquet attended by over 400 persons including executives of the leading parts companies. With a 66-page edition the Kenosha *Evening News* commemorated the occasion. Throughout the day floral tributes and hundreds of congratulatory messages were received at the company offices. In commemoration of the civic appreciation for the part which Nash Motors has played in development of the community, Ralph S. Kingsley, chairman of the civic committee, presented a plaque to Nash President E. H. McCarty and for the part which Charles W. Nash, founder and chairman of the company, played in the organization and administration of the company a momento was presented in the form of a book of autographs of Kenosha people.

Mr. Nash has made good his promise to Kenosha said Kingsley. "Under his direction an automobile has been produced that not only has made good but has been the pride of all Kenosha. We are proud of the Nash Motors Co."

Responding to the tribute, Mr. Nash with characteristic modesty insisted that the lion's share of the credit for whatever success had been achieved should go to the workers who carried the dinner pail and to his associates in management. Gallantly, too, he paid tribute to Mrs. Nash who, he said, had been the inspiration and silent partner of all his endeavors during the past 50 years. Michael J. Cleary, president of the Northwestern Mutual Life Insurance Co., and principal speaker at the banquet, traced the growth and scope of the company, pointing out that its production to date totals more than 1,100,000 units valued at over $1,000,000,000 and that 436 industries sell all or part of their products to Nash.

Nash is one of 16 makes of cars surviving out of 205 existing in 1916. In 1918 Nash was the largest truck producer in the industry.

British Tourists Bring Own Cars for U.S. Trip

Bringing along their own cars, 83 young English men and women, members of the Junior Car Club of London, reached Washington late Wednesday on the first leg of a tour of the United States and Canada. On Thursday the party enjoyed a sightseeing trip in and around the nation's Capitol and in the evening were entertained by the American Automobile Association at an informal reception. The motor-tourists arrived at New York, July 27 aboard the Queen Mary and will embark at Montreal, Aug. 7 for the return voyage. Prior to reaching Washington, the tourists, coming from New York, were greeted in College Park, Md., at the University of Maryland by President Byrd.

The schedule of the tourists after leaving Washington follows: July 31, Washington to Uniontown, Pa.; Aug. 1, Uniontown to Cleveland; Aug. 2, Detroit; Aug. 3, Detroit to Niagara Falls; Aug. 4, Niagara Falls to Toronto; Aug. 5, Toronto to Ottawa; Aug. 6, Ottawa to Montreal; Aug. 7, embark S. S. Duchess of Richmond for Liverpool.

Sharp Dip Due This Month

(*Continued from page 133*)

treme heat which caused a relaxing of selling effort and indisposition on the part of the buyers. With the return of more moderate temperatures the final ten days of the month are expected to pick up the lost business of the preceding period. Moreover the last reporting period has 10 selling days compared with eight in the second ten days. Authorities estimate that the final figure for July will show a retail volume net over 10 per cent under that of June when approximately 449,000 cars and trucks were delivered to buyers in the domestic market.

Domestic retail sales of Buick cars thus far in July have exceeded those of the corresponding period of June, with every indication that the remainder of the month will maintain the unusually high rate, according to Buick's general sales manager, W. F. Hufstader. Sales during the second 10 days of July were 4376 units, compared with 3988 deliveries in the corresponding period of the previous month and 1969 in the second period of July, 1935. The total for the first 20 days of July is 9061 against 8753 in the corresponding period of June.

An all-time high in retail sales for the second 10-day period of July was set by Oldsmobile. In this period dealers delivered 5555 cars, an increase of 22 per cent over the same period in 1935, which had been the best previous record. In the first 20 days of July, Oldsmobile recorded retail sales of 11,500 units, an increase of 31 per cent over last year.

ATAM Meeting Endorses Plan For Cooperation with NADA

Close cooperation between the N.A.D.A. and local State dealer associations was foreshadowed by action taken by the Automotive Trade Association Managers at their annual summer meeting held in Montreal this week. The A.T.A.M. endorsed the program of activities presented by Arnon Benson, assistant to the N.A.D.A. president, and appointed a committee to meet with the N.A.D.A. executive committee in Detroit on Aug. 10, 11 and 12 to work out plans for the vigorous development of the N.A.D.A.

De Soto's New $5,000,000 Plant to Open Next Month

K. T. Keller, president of Chrysler Corp., announced this week that, to take care of De Soto's growing business, a new automobile plant will be opened in Detroit in September for the production of De Soto passenger cars. This will give De Soto, for the first time, an exclusive plant of its own. With the opening of the new plant, each of the corporation's major lines of cars and trucks will be built in separate plants.

The new De Soto plant will consist of two buildings: one heretofore known as the company's Wyoming plant, which is now being remodeled and equipped to assemble cars; and the other, an entirely new press building, now being erected, for sheet metal stampings. Both buildings will be newly equipped with machines, tools and other facilities designed and laid out to assure the highest standards of quality and workmanship as well as larger output.

This expansion of the corporation's production facilities will represent an investment of approximately $5,000,000 and will provide additional employment in Detroit for about 1750 employees. When the new plant gets into operation, it is expected to produce approximately 500 finished cars a day.

Spanish Branches Safe

Barcelona Ford and GM Plants Protected by Consul

The American Consul at Barcelona on Thursday telephoned the State Department in Washington that so far he has been successful in protecting American plants in that city of revolution-torn Spain. Both the Ford Motor Co. and General Motors Corp. have plants in Barcelona. The consul's message came on the heels of reports that American plants in Barcelona had been seized by Communists. The Consul informed the State Department that there is no confirmation of reports that labor groups are occupying industrial plants in that city.

Erie Wendelin, Chargé d'Affaires at Madrid, in a cable received Wednesday said that private automobiles of some American citizens had been requisitioned by the Spanish government for war purposes but that there had been no confiscation of bank deposits. A moratorium on loans has been declared and a limitation placed on withdrawals.

:SLANTS:

AIR TRAVEL—*Two-cent rail fares are resulting in increased business for railroads, but not at the expense of the airlines, according to reports from Pennsylvania Airlines. A new high record of 6196 passengers carried on the Washington - Detroit - Milwaukee route was made in June. . . . The air express division of Railway Express Agency also reports better business with a total of 35,434 shipments handled last May, an increase of 60 per cent over May, 1935.*

TO DALLAS—*A trip to the Texas Centennial Exposition as guests of the Ford Motor Co. will be the reward for all Ford dealers selling at retail 200 or more new vehicles during the months of July and August. In addition to these rewards, each branch territory will be divided into population divisions and the leading dealer in each, exclusive of the 100-car dealers, will be invited to the exposition with all expenses paid.*

USED CAR HARVEST—*To stimulate used car sales, the Ford Motor Co. will give each harvest month—July, August and September—a cash award of $100 to the exclusive used car salesman in each population division of the branch territories whose net volume of used car and truck sales, on a dollar basis, is the highest.*

MEXICO—*Robert D. Morris, treasurer of Studebaker's Mexican distributor, on a recent visit to the factory said that the automobile is already reaping benefits from Mexico's vast road-building program. Great increase in Mexico's tourist trade, he says, is expected from the new international highway recently opened from Laredo, Tex., to the republic's capital city.*

SAFETY SPEEDOMETER — *The "Keystone Motorist," published by the Keystone Automobile Club, has this month on its cover a "safety speedometer" showing at a glance, by means of five concentric circles, the relation between speed in m.p.h., distance covered in ft. per second, average braking distance, average reaction time in terms of ft. per second, and the average stopping distance. Background of the speedometer is red for speeds over 40 m.p.h. It has been suggested that the idea be incorporated in actual speedometer dials to educate drivers on the risks inherent in high speed.*

NEAL TAYLOR HALL has been appointed advertising manager of the Bendix Products Corp., South Bend, Ind. A graduate of the University of Wisconsin, Mr. Hall has been assistant advertising manager of the Wurlitzer Co., Cincinnati, and prior to that was an executive of the Burns-Hall advertising agency of Milwaukee.

CHARLES S. DAVIS, president of Borg-Warner Corp., has been elected a director of the City National Bank and Trust Co., Chicago.

GEORGE W. DERR, who has been connected with the National Automobile Dealers' Association since 1927, has resigned from this organization to enter a commercial enterprise in Chicago.

HERBERT DANIELS has been appointed manager of the Motor and Equipment Wholesalers Association's department for the interchange of members' experiences on lines handled.

C. S. VANE, for 11 years general manager of the National Automobile Dealers Association, has been appointed Pacific Coast manager of the trailer division of Mullins Mfg. Corp., of Salem, Ohio. Mr. Vane will have his headquarters in Los Angeles and San Francisco, and will direct sales and distribution of the Red Cap trailer.

HARVEY E. MACK, well known in Detroit automobile merchandising circles, has been appointed manager of the retail store of the Pontiac Motor Co., in Pontiac, Mich. For the past few months he has been used car manager of the retail store on Cass Avenue, Detroit.

GLEN D. ANGLE, M.E., has joined the firm of Grow, Joy & Co., finance and consulting engineers in aviation, with offices at 2017 Penobscot Bldg., Detroit. Mr. Angle has had many years of experience with aircraft engines and is the author of several books dealing with certain phases of the design of such engines.

The Horizons of Business

By Joseph Stagg Lawrence

The Drought as a Campaign Factor

IN spite of liberal, if not excessive, press embellishments and a few sober Government condition-reports the precise damage inflicted by the drought remains an uncertain quantity. The commodity markets express their perplexity by capricious fluctuations which strain the limits established by the law. Nevertheless, certain facts not susceptible of exact statistical expression are clear.

The first of these is the fearful responsibility which a power hungry government of men has invited. Through the A.A.A., now deviously metamorphosed into the S.C.A., and almost countless accessory agencies the Government has taken over the task of regulating the economic destinies of agriculture. That the effort may be a meretricious prescription of the snake-oil variety is beside the point. Our Government has told some six million farmers that it will preside over the distribution of the national income to the end that the farmer will obtain his fair share, whatever that may be, or however it may be ascertained. Thus a government of men speeds to temper every act of God that may have an adverse effect upon the income of the farmer.

Now this is a most unenviable posi-

(*Turn to page 160, please*)

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

General business activity registered another moderate gain last week, with the output of electricity, steel, and coal larger. With the exception of some showers in the eastern portion, the drought in the spring wheat belt continued. The high temperatures and absence of rain have taken a heavy toll on the corn crop. Temperatures in the cotton regions were more moderate last week and showers rather general, excepting in the northwestern parts.

Guaranty Trust Index Advances

The index of business activity, compiled by the Guaranty Trust Co., for June stands at 85.4, as against 82.2 the month before and 71.3 in the corresponding period last year. Last month's advance brings the index to the highest level since October, 1930. The Company's index of wholesale commodity prices on July 15 was 55.9, as against 54.1 a month earlier and 53.9 a year ago. The index now stands at the highest level since October, 1935.

Carloadings Steady

Railway freight loadings during the week ended July 18 totaled 720,402 cars, which marks a decline of 3922 cars below those in the preceding week, an increase of 127,730 cars above those a year ago, and an increase of 104,362 cars above those two years ago.

Food Costs Rising

According to the Bureau of Labor Statistics, retail food costs during the two weeks ended June 30 rose by 0.5 per cent. The current index stands at 84.3, as compared with 83.8 two weeks earlier and 82.1 four weeks earlier.

Insurance Business Better

Life insurance sales in the United States during June made the best showing of any month in the first half of this year. The total was 9 per cent above that a year ago, whereas sales in the first half of the year were 8 per cent below those in the corresponding period last year.

Oversea Trade Gains

Foreign trade during June continued to exceed that a year ago. Exports were 9 per cent above those a year ago, while imports increased 23 per cent. As compared with May, exports declined 8 per cent, which is slightly more than the usual seasonal amount, while imports, which usually decline in that month, showed a slight increase.

Fisher's Index

Professor Fisher's index of wholesale commodity prices during the week ended July 25, stood at 83.2, as against 83.3 the week before and 83.8 two weeks before.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended July 22, showed no changes in holdings of discounted bills, bills bought in the open market, and government securities. Money in circulation declined $37,000,000, and the monetary gold stock increased $5,000,000.

Reeves Protests Diversion of Taxes Paid by Motorists

Strongly protesting against the diversion of motorists' taxes to uses not even remotely related to the benefit of the drivers or the pedestrians on our highways—totaling $641,000,000 during the past ten years, Alfred Reeves, vice-president of the Automobile Manufacturers Association, speaking before the Automotive Trade Association Managers at the Mt. Royal Hotel in Montreal this week, asked that more of the motor fees be applied to safety efforts by the states and communities exacting such taxes.

"Officials of states that have diverted taxes taken from the motorists to non-automotive purposes, cannot evade the responsibility for the loss of life and limb on their highways," declared Mr. Reeves. "Last year in the United States motorists paid a total of $1,286,000,000 in taxes, an average of $49 per vehicle. This includes taxes on gasoline, horsepower, weight, value, seating capacity and insurance.

"If a reasonable percentage of the vast amount of taxes taken from motorists were applied to highway patrols and other safety efforts it would mean the saving of thousands of lives and tens of thousands of serious injuries.

"Overburdensome taxation and unnecessarily high traffic accident and death rates combine to detract measurably from the desirability of car ownership or operation. They are among the greatest elements of sales resistance faced by automotive merchandisers. They are problems that can be solved more effectively if, in their own localities, the dealers will be more aggressive in helping toward their solution."

Hayes to Make Tourist Trailers

Chassis and Part of Walls to Be Steel but Light as Wood Types; Ionia Plant May Be Reopened

Hayes Body Corp. is entering the tourist trailer field with a steel frame house trailer which it expects to put in production at its Grand Rapids plant this fall. The design developed by Hayes differs from most trailers now on the market in that the chassis body frames and part of the sides will be of steel. Most trailer manufacturers at present use wood, or wood reinforced with steel for the chassis, wood body frames and bows and composition walls. Weight and manufacturing costs of the Hayes trailer are said to be about the same as those made chiefly of wood.

Since trailer manufacturing is essentially a body business, the company considers its plant as ideal for this product, being equipped with presses and assembly lines which can be used to advantage.

The Hayes trailer will be marketed through automobile dealers. The new operations may necessitate reopening the company's Ionia plant which has been closed for several years.

40 Years Ago

—with the ancestors of AUTOMOTIVE INDUSTRIES

Last month a gay assemblage convened at Spa, a well-known watering place of Belgium, to do honor to the motor vehicle. The brilliant program included banquets, speeches, festivals, races, an exhibition, etc., and was thoroughly enjoyed by the members of the Automobile Club Belge and their guests.

Eight motor vehicles were mustered, including a petroleum tricycle of De Dion Bouton & Co., owned by the president of the Automobile Club of France. Most of the vehicles shown were driven by Daimler motors.

Among the distinguished guests were the Baron de Zuylen de Nverelt, president of the Automobile Club of France, the president of the Automobile Club Belge, and Prince Albert of Belgium.

—From *The Horseless Age*, August, 1896.

Automotive Metal Markets

Copper Buyers Place Huge Orders Before Price Advance; Motor Steel Orders Continue Heavy

By William Crawford Hirsch

The spectacular volume of business booked by copper producers on the eve of the latest ¼ cent per lb. price advance, estimated at upwards of 150,000 tons, has attracted considerable notice among automotive consumers who buy wrought copper and brass products from fabricators. A good deal of the business booked before the advance was from fabricating subsidiaries or affiliates of the large copper producers, but all buyers of unwrought copper had the opportunity to cover at 9½ cents before the advance to 9¾ cents.

Advances in the prices of wrought copper and brass products, ingots, wire, etc., became effective to the extent of the rise of the price in the raw metal immediately following the advance, although in some cases regular customers were given a day's grace to enable them to place a limited amount of business on the basis of the lower copper price. This having been the second time this year that the copper producers announced a price advance in this manner, the rise from 9¼ to 9½ cents on April 14 also having been preceded by a brief leeway, it is assumed that this has come to be the conventional method for future mark-ups.

Buyers of copper in its fabricated forms point out that this method has the disadvantage of affording to fabricators large savings by their getting under the wire before the advance, while these are not, to any considerable extent at least, passed on to them.

In 1929, copper consumption by automotive consumers, aside from the metal that went into bearings, bushings, lubricators, valves and fittings, was reported by the American Bureau of Metal Statistics to have been 138,200 short tons or 276,400,000 lb. On this basis, ¼ cent advance means $691,000 added to the industry's copper bill.

In the steel market, considerable business continues to accumulate from automobile manufacturers as well as parts makers. A good part of it is for rush shipment. Bar stock orders run relatively heavy. A Pittsburgh producer has announced revised prices on cold finished bars for Detroit and Eastern Michigan points, the new prices taking the same transportation charges over the Pittsburgh base as apply on hot rolled carbon steel bars.

Pig Iron—With some automotive foundries marking time pending new model production, business is spotty. The feeling is growing that prices will remain unchanged over the remainder of the year.

Aluminum—Routine conditions prevail generally.

(*Turn to page 161*)

Index on Press

Larger, Re-vamped Model Will Be Even More Useful, We Hope

Containing 20 pages and overhauled completely from first to last reference, the index to AUTOMOTIVE INDUSTRIES covering issues for the first half of 1936 is now on press, and will be available to subscribers within a few days.

Expense of printing does not justify broadcast mailing of the Index, but we will gladly send a copy to any subscriber on request.

Always a usable tool, the current Index has been carefully redesigned to augment its readability and accessibility. Many readers regard it as a valuable refresher on automotive news events of the six months past.

Calendar of Coming Events

SHOWS

Automobile Salon, Oriental Fair, Lwow, Poland .....Sept. 5-15
International Automobile Section, 7th Levant Fair, Bari, Italy .....Sept. 6-21
30th Automobile Salon, Paris, France, Oct. 1-11
Olympia Motor Show, London, England, Oct. 15-24
Czechoslovakia, 26th International Automobile Exposition, Prague....Oct. 16-25
9th International Automobile Salon, Milan, Italy .....November
National Motor Truck Show (N. J. Motor Truck Assn.), Newark, N. J., Nov. 3-7
National Automobile Show, Grand Central Palace, New York .....Nov. 11-18
International Aviation Show, Paris, France .....Nov. 13-29
Boston Automobile Show.....Nov. 14-21
Columbus Automobile Show.....Nov. 14-20
Chicago Automobile Show.....Nov. 14-21
Detroit Automobile Show.....Nov. 14-21
Washington, D. C., Automobile Show, Nov. 14-21
Cincinnati Automobile Show....Nov. 15-21
St. Louis Automobile Show.....Nov. 15-22
Philadelphia Automobile Show, Nov. 16-21
Pittsburgh Automobile Show ...Nov. 16-21
Brooklyn Automobile Show.....Nov. 21-28
Cleveland Automobile Show.....Nov. 21-28
Kansas City Automobile Show..Nov. 21-29*
Milwaukee Automobile Show...Nov. 22-29
Baltimore Automobile Show.Nov. 26-Dec. 5
23th Automobile Salon, Brussels, Belgium .....Nov. 28-Dec. 9
Peoria Automobile Show....Nov. 30-Dec. 5*
Natl. Exposition of Power & Mechanical Engineering, Biennial Meeting, New York City .....Nov. 30-Dec. 5
Automotive Service Industries Joint Show, Chicago .....Dec. 9-13

* Tentative dates.

CONVENTIONS AND MEETINGS

National Association Power Engineers, Annual Meeting, Chicago, Aug. 31-Sept. 4
American Chemical Society, Semi-annual Meeting, Pittsburgh, Pa., Sept. 7-12
World Power (Fuel) Conference, Washington, D. C. .....Sept. 7-12
Annual Meeting and Convention of the National Association of Sales Finance Companies, Hot Springs, Va. .....Sept. 14-16
American Transit Association, Convention, White Sulphur Springs, W. Va. .....Sept. 21-24
North American Gas Tax Conference, Richmond, Va. .....Oct. 6-9
First Aircraft Production Meeting of the S. A. E., Los Angeles...Oct. 15-17
Annual Meeting of the National Association of Motor Bus Operators, Detroit, Mich. .....Oct. 15-16
American Society for Metals, 18th Nat'l Congress, Cleveland, O.....Oct. 19-23
16th Annual Meeting of the American Welding Society, Cleveland, O., Oct. 19-23
American Gas Association, Annual Meeting, Atlantic City.....Oct. 26-31
American Petroleum Institute, Annual Meeting, Chicago.....Nov. 9-12
National Foreign Trade Convention, Chicago .....Nov. 18-20
Natl. Industrial Traffic League, Annual Meeting, New York City.....Nov. 19-20

CONTESTS

100-Mile National Championship, New York State Fair, Syracuse....Sept. 12
First Annual 400-Mile International Sweepstakes, Roosevelt Raceways, L. I. .....Oct. 12
500-Mile International Sweepstakes, Los Angeles Raceway .....Nov. 29

Buckeye to Double Output Of Bumpers, Add Hub Caps

Expansion of plant operations of Buckeye Bumpers, Inc., Springfield, Ohio, to double the 1936 production of bumpers and to provide for the manufacture of hub caps and spring covers has been announced by B. F. Fortier, vice-president and general manager. Buckeye Bumpers is a division of Electric Auto-Lite Co.

Production on 1937 bumper contracts will start Aug. 15, with a daily output of 5000 scheduled. The addition of hub caps and spring covers to the products of the plant will increase employment by 300 persons and necessitate an expenditure of $100,000 for new equipment and plant changes.

As the work goes on—

Finished gears form an interesting geometric pattern as they come from the gear cutting department. They are all washed thoroughly before entering the inspection department.

THIS MONTH'S PRODUCTION FEATURE

End of the overdrive transmission assembly line. The next step is the test room where each unit must prove that it's sufficiently quiet to satisfy the customer

Transmissions to the World

in an ever steady flow from the Warner Gear factory fill the varied needs of cars and trucks everywhere

By Joseph Geschelin

IF you take the transmission plants of 46 different passenger car and truck factories, reduce design variations by using interchangeable parts wherever practicable, and then pour them all into a single unified mold, you will have some impression of the world's largest independent transmission manufacturing plant—Warner Gear Division of Borg-Warner, Muncie, Indiana.

Without counting the different models made for each customer, Warner Gear Co., serves 16 passenger car builders including one of the largest units in the industry, 25 truck manufacturers, and two equipment builders. Eight of the customers are foreign producers covering the boundaries of Europe and Asia, from Finland, Sweden and Spain on the West Coast to Japan in the Far East.

Production facilities are housed in three separate plants having a total floor space of 653,000 sq. ft. When running full time the operation employs a total of 3500 people. Plant 1 is devoted exclusively to passenger car transmissions including the new overdrive units; Plant 2 produces truck transmissions; and Plant 3, the most recent addition, built in the sub-zero weather of last winter, is a complete service establishment producing a varied line of replacement parts, service parts, and synchronizer units.

Generally speaking, the line of products encompasses the following—three and four-speed truck transmissions, three-speed synchromesh passenger car transmissions, integral overdrive transmissions, separate overdrive attachments, and free-wheeling units. In addition there is a varied line of replacement and contract parts including transmission gears, differential gears, ring gear sets, clutch parts, power take-off units, and cylinder heads.

In 1935 the company shipped 378,985 transmissions. Shipments for the first six months of this year total 222,112 transmissions.

Apart from those who are close to the problem, few people realize the character of the scientific skills which must be brought to bear on the production of today's transmission. Quietness of operation, great torque capacity within a relatively small package, and freedom from service troubles are just a few of the requirements. Yet all have to be met with a product held within rigid cost limits.

Years of specialization have convinced this company that metallurgy is a vital element in the production of

specifications and contact with forging plants to assure conformity with established practice.

Routine checks are made of steel samples from the steel mills while forging samples, particularly on runs made from new dies, are tested to assure proper structural pattern. In addition, the metallurgical department arranges for regular visits to the forge shops and steel mills as a first hand check on quality.

(Top) This V-52 American broach is used to rough-broach the spline tooth form in bore of synchronizer rings. It handles two pieces at a time. A smaller machine, the V-2, 8-ton American, is used to finish-broach

(Left) Profile of overdrive clutch pawls is finished completely on this Foote-Burt vertical surface broaching machine

modern transmissions (coupled with manufacturing techniques utilizing the very latest types of machinery and inspection devices. The metallurgical department, in cooperation with engineering and production, first establishes the steel specification and heat treatment for each individual part. With this as a starting point, it sets up controls for annealing and heat treating in the plant, followed by close contact with the steel mills to assure conformity to

Warner Gear Company
Factory Executive Personnel

C. S. Davis	President
J. M. Simpson	Vice-President & General Mgr.
E. B. Baltzly	Vice-President
G. W. Bunner	Vice-Pres. in charge of Mfg.
J. O. Moore	Superintendent
Harry Baney	Assistant Superintendent
Chas. Clark	Assistant Superintendent
Clay Moody	Assistant Superintendent
E. G. Guy	Production Manager
Lewis Reed	Assistant Production Mgr.
Floyd Duncan	Assistant Production Mgr.
A. B. Bolender	Tool Supervisor
A. E. Gnagi	Assistant Tool Supervisor
W. L. McAllister	Standards
Marion Mongrain	Tool Room Superintendent
J. H. Orr	Factory Engineer
E. F. Davis	Chief Metallurgist
R. W. Peters	Assistant Chief Metallurgist
S. O. White	Chief Engineer
Vaughn Haigh	Executive Engineer
Frank E. Brown	Quality Engineer
H. J. Wilson	Works Accounting
R. M. Allison	Director Service Sales

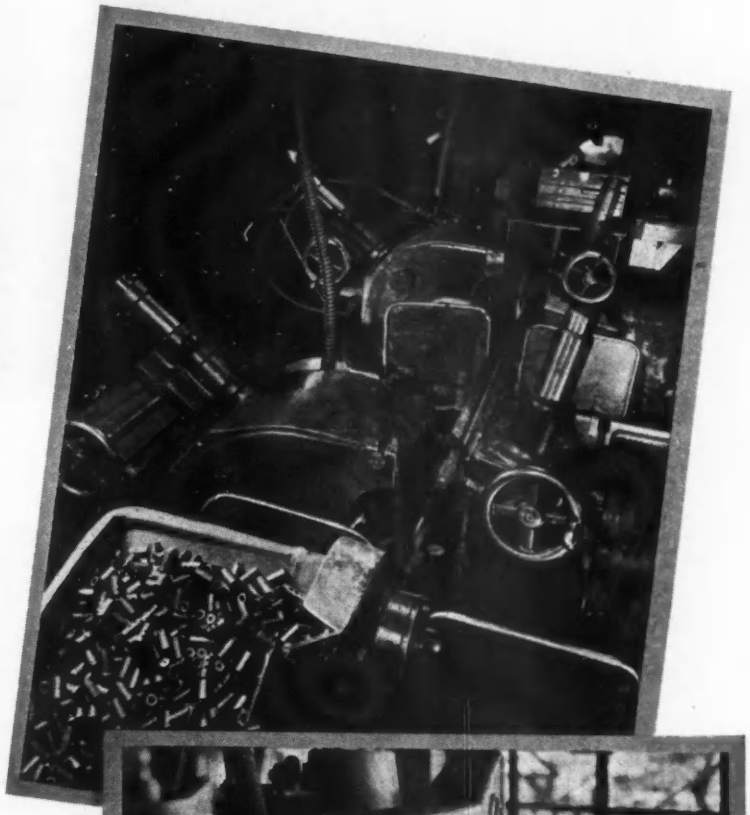
Warner Gear Division was the first to adopt a special medium carbon type nickel-molybdenum steel for transmission gears in 1932 and today uses 90 per cent of all SAE 4640 steel, as it is now classified, produced in this country. From a structural point of view the chief advantage of this material is its high fatigue resistance due to ability to develop high tensile values by heat treatment without a corresponding loss of ductility.

The structural properties of the material have been a marked factor in the development of compact transmission units capable of handling the greatly increased torque capacity of modern engines without sacrificing the high power-to-welght ratio demanded of the present day motor vehicle. But that's only a part of the story. Quietness is demanded in all motor vehicles and each component, particularly the transmission with its trains of highly stressed and fast moving gear teeth, is required to contribute its share of noise reduction. This is by no means a simple problem as any production man will testify since fire distortion will ordinarily destroy the most precise manufacturing limits.

Fortunately this special gear steel combines the desirable physical properties with a unique resistance to volume changes and fire distortion during heat treatment. As a matter of fact it lends itself to delayed quenching and "trick" heat treatments for intricate parts where distortion ordinarily would be a great problem.

All in all this material is the answer to the gear maker's prayer and gives both engineering and production a sound foundation on which to build an acceptable product at a competitive price.

The entire philosophy of the manufacturing department is based on the ideal of quality in both gear cutting and heat treating coupled with high quality levels on the more conventional metal cutting operations. Even a cursory visit through the plant reveals a policy of modernity not only in the routing of operations but in the use of the very latest equipment that the



(Top) Pinion shaft O.D. is rough and finish-ground automatically on this battery of two Cincinnati centerless grinders fed by the Danly In-Feed loader in the foreground

(Right) No. 16 Blanchard surface grinder is a versatile tool. It handles flat washers, large and small, or gear blanks with equal facility

(Left) Main shaft spiral splines ground on Fitchburg semi-automatic grinder

(Right) Double over-arm Barber-Colman hobber is used for forming splines on main shaft. This is one of three separate set-ups

Factory Routing on Main Shaft

Operation	*Equipment*
Cut-off	No. 203 Campbell Abrasive Cut-off Mach.
Anneal	McCann-Harrison Continuous Annealing Furnace
Rattle	48x42 American Wheelabrator Tum-Blast Machine
Center both ends, rough & finish turn 7 diameters, cut 2 grooves & 2 recess cut 3 chamfers, mark shoulder & cut recess on pilot.	Sundstrand Centering Machine 19 S Fay Lathe
Rough & finish turn thread diameter	16x8 Monarch Lathe
Face & recenter pilot end	16x8 Monarch Lathe
Green grind large diameter	10x36 Norton Cylindrical Grinding Mach.
Green grind small spline diameter	10x36 Norton Cylindrical Grinding Mach.
Green grind pilot diameter	10x36 Norton Cylindrical Grinding Mach.
Cut thread	H & G Threading Machine
Mill flat on thread	No. 1 RV Kent-Owens Hand Milling Mach.
Hand die threads	Bench
Wash	Crescent Model 1B Washing Machine
Inspect	Bench
Hob spiral spline	Type A Barber-Colman Hobbing Mach.
Hob medium spline for —2½	No. 12 Double Over-Arm Barber-Colman Hobbing Machine
Hob small spline	No. 12 Double Over-Arm Barber-Colman Hobbing Machine
Drill one lock plunger hole	1 Spindle High Speed Allen Drilling Mach.
Wash	Crescent Model 1B Washing Machine
Inspect	Bench
Carburize	
Harden	
Inspect	
Grind center in pilot end	No. 75A Heald Internal Grinding Mach.
Grind center in thread end	No. 75A Heald Internal Grinding Mach.
Indicate	Brown & Sharpe Indicating Fixture
Grind sides of spiral splines	Fitchburg Universal Semi-Automatic Spline Shaft Grinding Machine
Rough grind gear seat diameter	10x36 Norton Cylindrical Grinding Mach.
Finish grind gear seat diameter	10x36 Norton Cylindrical Grinding Mach.
Grind pilot diameter & face shoulder	10x36 Norton Cylindrical Grinding Mach.
Grind large bearing diameter & true up shoulder	10x36 Norton Cylindrical Grinding Mach.
Grind medium spline diameter	10x36 Norton Cylindrical Grinding Mach.

market affords. Just about every modern gear cutting technique known to the art will be found either in routine or experimental production—Fellows gear shapers, Barber-Colman hobbers, Michigan Tool gear shavers, Cim-

(Above) Threading end of main shaft on H & G threading machine.

(Right) Medium spline diameter being ground on a 10x36 Norton machine.

atool chamfering machines, National Broach Red Ring lappers, etc.

In general, gears are roughed on Barber-Colman hobbers and finished on Fellows gear shapers. However, a certain percentage of production gears are roughed by hobbing with some stock left for finishing and then finished by shaving on Michigan Tool machines. There is sufficient variety of manufacturing methods to suit the requirements of any customer.

In starting the operations through the plant, gear blanks are received in the form of drop forgings which are carefully annealed under close control. Then the work goes through the Wheelabrator for an exceptionally fine tumbled finish preparatory to metal cutting operations. An American Wheelabrator unit has been installed in each of the three plants to facilitate this work. Although many parts are heat treated by conventional pack hardening methods, the preferred method is cyanide hardening in special continuous cyanide baths developed and patented by the company. An excellent example of the continuous bath equipment is found in Plant 3 and represents the latest advance in the art. The metallurgical department also has developed several gas atmosphere draw furnaces with automatic conveyors.

Quality control for all manner of manufacturing operations is evident at every turn. Heat treating equipment is automatically controlled by means of Leeds & Northrup temperature controllers; gears are checked individually by means of various testing devices to assure the maintenance of tooth thickness, tooth spacing, pitch diameter and lead; gear sets are matched and run in and all assembled transmissions pass the gauntlet of quiet rooms as the final criterion of acceptance.

A Complex Set-up

When it comes to an actual trip through this plant, one is hard put for a simple but understandable means of showing the reader around for we have here a rather complex set-up with a tremendous activity packed into a relatively small area. In a somewhat feeble attempt at rationalizing the productive process, we have selected a number of representative parts in each plant for the purpose of illustration, also with the hope that these high spots will create some impression of the overall picture. Each of these high spots will be found to correspond with an operation on one of the half dozen or so factory routing sheets which are also given in detail.

The series of illustrations in the article are outstanding as examples of industrial art and show vividly some of the operations that took our fancy, re-

flecting in no small measure the spirit of modernity that prevails.

Before plunging into the formal analysis of departmental operations,

Countershaft bores are rough-broached on an Oilgear vertical broaching machine directly after drilling.

Single purpose Baker drill and 19S Fay automatic form a battery on this operation on the countershaft gear. Drilling four drive holes, rough turn O.D., rough recess, face, etc.

let us take a look at a few specialized details which are illustrated elsewhere in this article. Broaching represents a fair share of applications particularly in finishing straight and spline holes. We have shown two American broaching machines used for synchronizer rings. The first of these roughs the spline tooth form in the blanks, handling two forgings at a time; the second machine does the finishing to specified limits, one at a time.

An example of the modern mode of surface broaching is found in the contour-finishing of overdrive clutch pawls on a Foote-Burt vertical machine fitted with multiple broaches. It takes the

Factory Routing on

Operation	*Equipment*
Anneal	McCann-Harrison Continuous Annealing Furnace
Rattle	48x42 American Wheelabrator Tum-Blast Mach.
Drill shaft hole	No. 121 Single Purpose Baker Drilling Mach.
Rough broach shaft hole	Oilgear Vertical Broaching Machine
Drill 4 drive holes, rough turn O.D. all gears, rough recess & face large gears down to drive holes & chamfer shaft hole, one end	No. 121 Single Purpose Baker Drilling Mach.
Drill one oil hole, finish broach shaft hole, rough & finish face & cobore large gear end	19 S Fay Lathe
Finish turn, face & recess all gears complete, break corners with file, chamfer shaft hole one end, stamp heat symbol, material & "W" in circle	21 1 Spindle Cincinnati Vertical Drilling Mach.
Inspect	1 Spindle High Speed Allen Drilling Mach.
Block 14 teeth	V2-3 Ton American Hydraulic Broach
Semi-finish cut 25 teeth	19 S Fay Lathe
Finish cut 14 teeth	19 S Fay Lathe
Block 19 teeth	21 Single Spindle Sibley Vertical Drill
Finish cut 19 teeth	Warner Gear Co. Reaming Head & Stand
Semi-finish cut 32 teeth, burr 4 drive holes & file ends of gear	Bench
Chamfer acute angles on both ends of 32 teeth & one end of 14 teeth	No. 12 Double Over-Arm Barber-Colman Hobbing Mach.
Chamfer acute angles on both ends of 25 teeth	No. 12 Double Over-Arm Barber-Colman Hobbing Mach.
Chamfer 19 teeth one end (3-cuts)	No. 75 Fellows Gear Shaper
Burr both faces of 32 & 25 teeth, one end of 19 teeth & one end of 14 teeth	No. 75 Fellows Gear Shaper
	No. 75 Fellows Gear Shaper
	No. 12 Double Over-Arm Barber-Colman Hobbing Mach.
	1 Spindle High Speed Allen Drilling Mach.
	Cinatool gear chamfering machine
	Peerless gear chamfering machine
	Peerless gear chamfering machine
	Warner Gear Co. reaming head & stand

(Above) Battery of grinders at work on countershaft. No. 72 Heald Sizematic at left grinds bore while the rotary surface grinder at the right grinds the ends.

(Right) Shaving 25 and 32 tooth sections on countershaft gear on Michigan Tool shaving to correct contour prior to heat treat.

Countershaft Gear

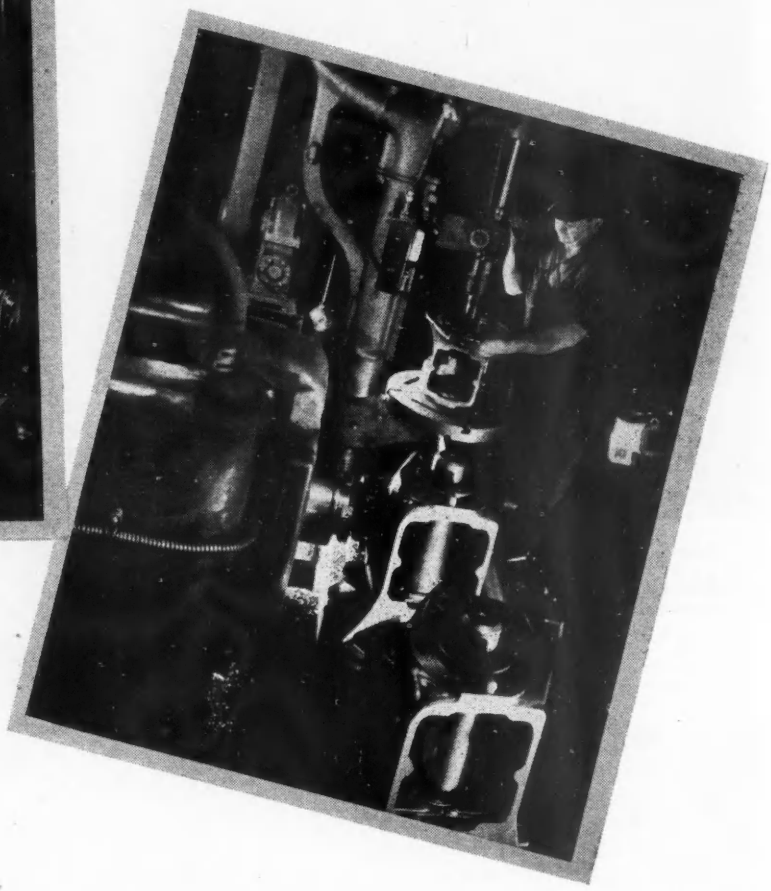
Wash	
File burrs from one end off 14 & 19	Crescent Model 1B Washing Machine
Wire brush all members	Bench
Peel centers in both ends	Warner Gear Co. Special Polish Jack
Finish cut 25 & 32 teeth	16x8 Monarch Lathe
Burnish 32 spiral teeth	Michigan Rack Gear Finisher
Burnish 25 spiral teeth	Bolender Burnishing Machine
Burnish 19 spiral teeth	Bolender Burnishing Machine
Burnish 14 spiral teeth	Bolender Burnishing Machine
Wash & blow off	Crescent Model 1B Washing Machine
Inspect	
Truck to Dept. B4 at Plant No. 1	
Carburize	
Harden	
Inspect	
Grind hole & grind ends	No. 72 Heald Duplex Sizematic Grinding Machine
	22" Rotary Surface Grinding Machine
Wash	Crescent Model 1B Washing Machine
Inspect and MAKE INSLIP	
Burnish 32 spiral teeth	Bolender Burnishing Machine
Burnish 19 spiral teeth	Bolender Burnishing Machine
Burnish 25 spiral teeth	Bolender Burnishing Machine
Burnish 14 spiral teeth	Bolender Burnishing Machine
Wash	Crescent Model 1B Washing Machine
Nick teeth	Flexible Shaft & Motor Mounted on Bench
Inspect	
Lap 32 spiral teeth & wash	Fellows Gear Shaper Lapping Machine
Lap 25 spiral teeth & wash	Fellows Gear Shaper Lapping Machine
Lap 14 spiral teeth & wash	Fellows Gear Shaper Lapping Machine
Lap 19 spiral teeth & wash	Fellows Gear Shaper Lapping Machine
Match 9 & 11	Warner Gear Co. Matching Fixture
Match 10 & 14	Warner Gear Co. Matching Fixture
Match 8 & 16	Warner Gear Co. Matching Fixture
Match 13 & 12	Warner Gear Co. Matching Fixture

rough forgings, shown stacked in the extreme left corner of the table, and completes in two settings the entire contour on the concave side, including also the two faces. If one doubts the validity of keeping up with the changing picture of modern manufacturing techniques, just compare the productivity and cost of this method with the customary milling machine process.

Another example of modernity is the use of an automatic centerless grinder battery for finishing small cylindrical parts. As an illustration we have taken the set-up for finishing pinion shafts in great quantities. Here is a battery of two Cincinnati centerless grinders, one for rough-grinding, the other for finish-grinding. The battery is rounded out by the installation of a Danly In-Feed loader which takes the work into a hopper and regulates the flow into the grinders. An operator dumps the work into the hopper at one end and takes out the finished pieces at the other.

Great versatility is exhibited by a new No. 16 Blanchard surface grinder fitted with a magnetic table. It grinds the surfaces of large and small flat washers as shown but will also handle gear blanks with equal facility. For grinding small washers, it is found ex-

(Left) Truck transmission case machined in Plant 2. View shows 48 in. Newton miller rough and finish-milling cover face and rear end in two settings on table equipped with eight stations.



(Right) A battery at work on the truck case. Cincinnati Hydromatic miller mills face of pump pad while Aurora vertical drill in background chamfers bearing hole at both ends.

pedient to use a special fixture whose function is to serve as a separator so that the operator may readily sweep off the finished parts and replace them quickly for finishing the opposite side.

We made mention earlier of the American Wheelabrator used for tumbling forgings after annealing. As most of you know, it's called the Tumblast, a unique method of tumbling work while subjected to a revolving blast of abrasive shot. It is fast and most effective in producing a fine satin finish most suitable for the metal cutting tools. It happens that Warner Gear was among the very first of the automotive manufacturers to appreciate the virtues of the method.

Gear lapping is one of the most recent processes made available to the quality gear producer. This plant is using several machines now on the market including the Red Ring and Fellows, a battery of three Fellows machines being illustrated. They also have several new Fellows gear lappers, developed since the Machine Tool Show of 1935, in experimental production, all of which is calculated to keep the plant well ahead of the procession.

We should be remiss in our duty as an observer if we neglected to mention that this plant has a rather sizeable battery of Bullards in various departments, no less than eight of these dominating the scene in the overdrive ring gear section.

The metallurgical department enjoys an enviable reputation for its scientific skill. One of its major achievements is the development of the SAE 4640 steel as well as the technique of its commercial utilization. Complete details of this development were released for the first time in AUTOMOTIVE INDUSTRIES, July, 1936.

Perhaps one of the most intriguing processes produced by the metallurgical department is that of finish-broaching helical splines in hardened gears. It's done in this fashion. The gear blank is machined and the internal helical splines rough-cut, this being followed by heat treatment. In preparation for heat treat, the ring bore is fitted with a special metallic plug of chromium-nickel alloy and goes through the heat treat and annealing operations. Its object is to retard the rate of cooling and thus produce a softer case. In actual practice, the hardness of the tooth surface is around Rockwell C50 whereas the bore, when fitted with the plug, will come out around R_c30. The gears are then taken over to a vertical broach having a push broach of special design which is readily pushed through to finish the sides of the splines within the desired limits.

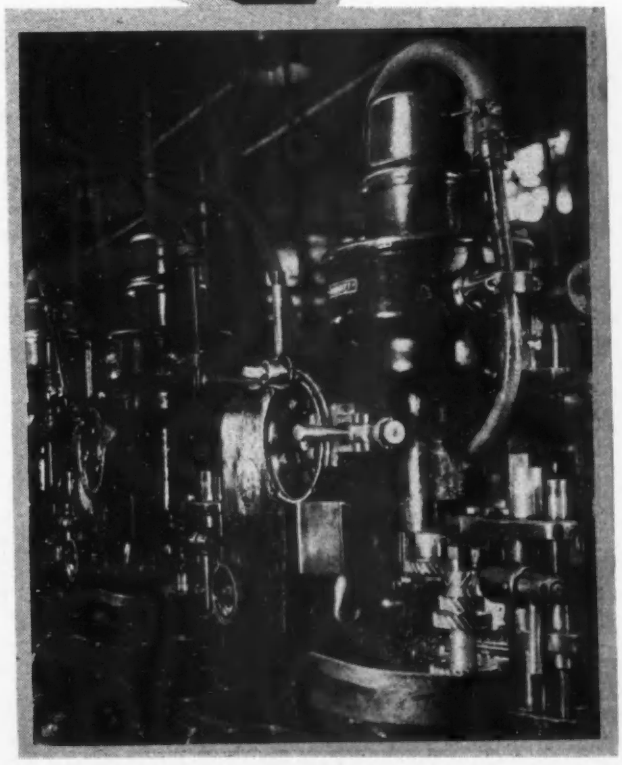
Making Passenger Car Transmissions

With the foregoing perspective we can make a brief excursion into the three main divisions, starting with Plant 1. This unit is devoted exclusively to the production of passenger car transmissions—three-speed synchromesh, integral overdrive, and overdrive attachment units—all parts—gears, shafts, cases, etc., being made

(Left) Natco multiple spindle drill with six-station fixture is used for drilling rear end, cover face, and pump pad. This operation takes three settings for each case.

(Right) Heavy-duty, single spindle Baker drills are used for drilling bore in countershaft forging prior to broaching.

(Lower right) This group of Fellows gear shapers finishes gear teeth on countershafts. Operation in foreground is that of finishing 14 tooth section.



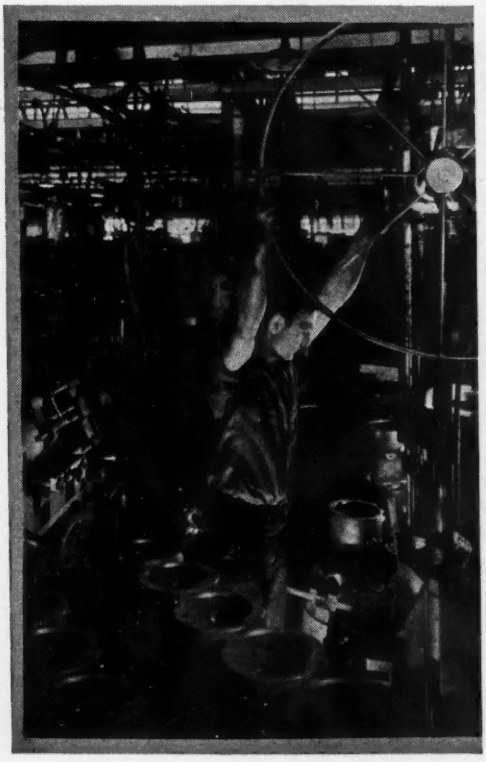
here. The final assembly lines are located here and finished units are shipped directly to the customer from this plant.

Among the major departments located in this plant are the following—automatic screw machine, gear blanking, gear cutting, gear grinding and lapping, case machining, heat treating, test stand, metallurgical inspection, final assembly.

In the gear cutting department you will see a fine battery of new Michigan Tool gear shavers, the familiar Fellows gear shapers, a number of new Barber-Colman hobbing machines supplementing the machines which have been in use, National Broach gear finishers and three new Cimatool tooth chamfering machines. A rather interesting operation is the use of a Heald 72A Duplex Size-Matic for finish-grinding the bores of the cluster gear bushings. This ma-

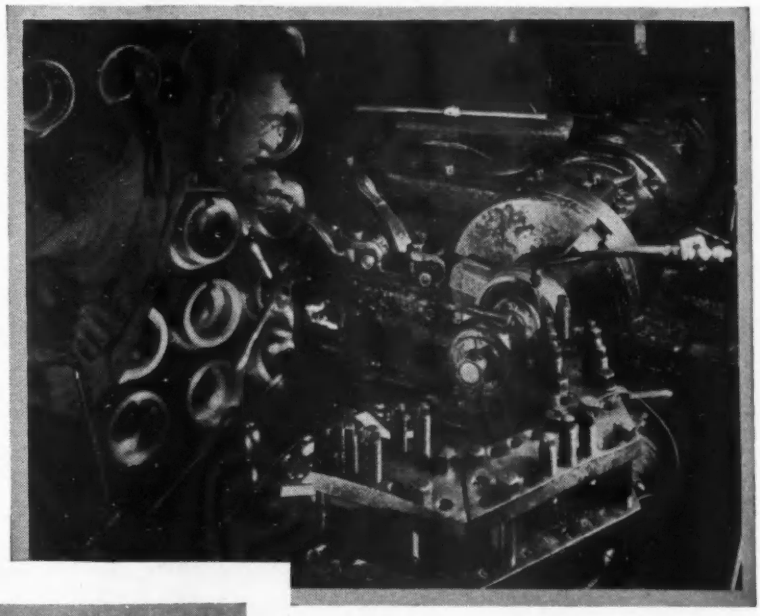
Boring and reaming on overdrive case in Plant 1 on this battery. Aurora drill in foreground line-reams M.B. and retainer bore. Natco duplex hydraulic boring mill in background bores and reams M.B. and retainer bores.

(Below) Natco duplex hydraulic boring mill drills and rough reams C.S. and idler shaft holes in overdrive case.



Transmission Case Routing on Overdrive

Operation	*Equipment*
Inspect	
Spray paint inside of case (case must be thoroughly dry before painting)	DeVilbiss Spray Paint Outfit
Bore & ream M. B. holes & Retainer bore	C4H Natco Duplex Hydraulic Boring Mill
Line ream M. B. & Retainer bore	24 Aurora Vertical Drilling Machine
Drill & rough ream C.S. & Idler Shaft holes	A4H Natco Duplex Hydraulic Boring Mill
Finish ream C.S. & Idler Shaft holes	22 Aurora Vertical Drilling Machine
Rough & finish face front end, face & recess for —4 gear, chamfer large bore on F.W. case, chamfer bore for —4 gear & chamfer front M.B. hole (2 men)	8 6 Spindle Bullard Mult-Au-Matic
Mill cover seat	Cincinnati Hydraulic Vertical Milling Machine
Mill face of toggle & stop pin boss	No. 2 Cincinnati Horizontal Milling Machine
Mill face of 2 torque bracket bolt bosses	24 Cincinnati Duplex Milling Machine
Face coshaft bosses inside	No. 1 Warner & Swasey Head Screw Machine
Drill, cobore & ream toggle lever hole & drill stop bolt hole	No. 1A 4 Spindle Edlund Drilling Machine
Drill 6 sun gear screw holes, 8 rear end flange holes, oil tube hole & dowel hole	Natco Vertical Hydraulic Multiple Drilling Machine
Drill front end, retainer bolt holes, cover seat & drill 2 poppet holes	Natco Vertical Hydraulic Multiple Drilling Machine
Spot face oil tube hole in middle web—Mill clearance for overdrive shift fork	21 Cincinnati Vertical Drilling Machine
Check for ring gear clearance & grind if necessary	No. 2 Cincinnati Horizontal Milling Machine
Drill 2 torque bracket bolt holes	Flexible Shaft & Motor Mounted on Bench
Face idler bosses inside	Sundstrand Duplex Drilling Machine
Drill & ream overdrive rail hole	22 Aurora Vertical Drilling Machine
Ream dowel pin hole in middle web	2 Spindle High Speed Allen Drilling Machine
End mill C.S. & Idler key slots	No. 2 Avey-Matic Drilling Machine
Drill, cobore, spot face & tap screw hole in toggle lever boss	1 Spindle High Speed Allen Drilling Machine
Drill pin hole in stop bolt boss	24 Aurora Reversible Vertical Drilling Machine
Drill & tap oil filler in O.D. section	No. 2 Avey-Matic Drilling Machine
Rgh. & finish mill 2 shift rail slots	1 Spindle High Speed Allen Drilling Machine
Ream 2 poppet holes & drill 2 vent holes & spot face bolt boss in top	3x24" Cincinnati Hydromatic Milling Machine
Mill 2 fork stop pads & interlock slot	3 Spindle High Speed Allen Drilling Machine
Drill & tap oil filler & drain holes	No. 1 RV Kent-Owens Hand Milling Machine
Tap front & rear end, cover seat & hole in stop bolt boss	3x24" Cincinnati Hydromatic Milling Machine
Tap 2 torque bracket bolt holes	24" Cincinnati Bickford Vertical Drilling Machine
Tap 6 holes in middle web	Natco Multiple Tapping Machine
Re-ream C.S. & Idler hole	No. 2X Garvin Tapping Machine
Wash	No. 2X Garvin Tapping Machine
Burr & break corners inside, front & rear ends & cover face, blow & brush inside surfaces to remove sand & burrs	Warner Gear Co. 2 Spindle Reaming Head & Stand
Inspect and MAKE INSLIP	Crescent Model 1B Washing Machine
Finished Stock	

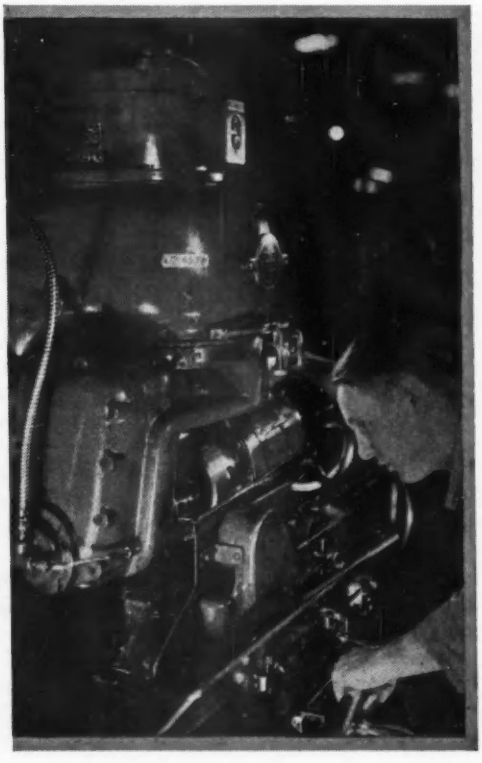


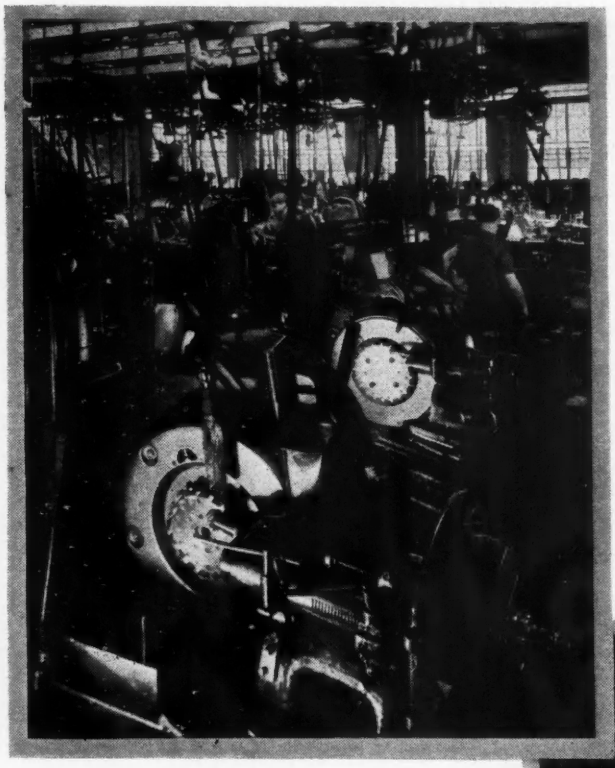
J & L flat turret lathe set up to finish ream bore for lockout gear and burr O.D. of gear, on overdrive ring gear.

Routing on Overdrive Ring Gear

Operation	*Equipment*
Anneal	McCann-Harison Continuous Annealing Furnace
Brinell test	Brinell testing Machine
Tumblast	48x42 in. American Wheelabrator Tum-Blast Machine
Rough large bore, rough face front end, rough face flange inside & rough turn & bore for lockout gear	8 in.-6 Spindle Bullard Mult-Au-Matic
Rough & finish bore & chamfer for lock-out gear, finish turn flange inside, rough & finish face flange end & semi-rough O.D.	8 in.-6 Spindle Bullard Mult-Au-Matic
Finish ream bore for lockout gear & burr O.D. of gear on end	3 in. J & L Flat Turret Lathe
Drill 3 rivet & 6 bolt holes & burr 3 rivet & 6 bolt holes outside	Natco Multiple Drilling Machine
Drill 2 Ferrule holes in O. D.	1 Spindle High Speed Allen Drilling Mach.
Cut recess back of tooth member, rough & finish cobore for bearing race, finish bore tooth diameter, finish turn O.S. & cut 3 chamfers	Sundstrand Double end Drilling Machine 8 in.-6 Spindle Bullard Mult-Au-Matic
Inspect	
Harden	
Inspect	
Stone front face & true up face of web	Heald Rotary Surface Grinding Machine
Grind bore for lockout gear	No. 75A Heald Internal Grinding Machine
Rough & finish grind OD	10x36 Norton Cylindrical Grinding Mach.
Finish grind inside face of web to thickness	No. 75A Heald Internal Grinding Machine
Bore internal diameter of teeth	16x8 Monarch Lathe
Grind front face to size & demagnetize	22 in. Heald Rotary Surface Grinding Mach.
Grind face, small end to O.A. length	22 in. Heald Rotary Surface Grinding Mach.
Cut 2 grooves in bore & face one end of teeth to length	16x8 Monarch Lathe
Grind bore for bearing race	No. 75A Heald Internal Grinding Machine
Co'sink 3 rivet holes & burr 6 bolt holes one side, burr 3 rivet holes & burr 6 bolt holes other side & ream 3 rivet & 6 bolt holes	3 Spindle High speed Allen Drilling Mach. 2 Spindle High speed Allen Drilling Mach.
Wash	Crescent Model 1B Washing Machine
Inspect	
Rough & semi-finish cut teeth & wash	No. 75 Fellows Gear Shaper
Finish cut teeth	Red Ring Gear Finisher
Ream 2 Ferrule holes in OD & wash	1 Spindle Cincinnati Vertical Drilling Mach. Crescent Model 1B Washing Machine.
Assemble 2 Ferrules & peen outside ends & file face	Bench & fixture
Grind radius on 2 Ferrules & grind burrs from face of teeth	No. 75A Heald Internal Grinding Machine
Burr inside end of 2 Ferrules & wash	Bench
Assemble R4-6 with R4-87	No. 3½ Greenard Arbor Press
Assemble & rivet 3 rivets, burr face, wash & blow	No. 3A High Speed Hammer Crescent Model 1B Washing Machine
Inspect & MAKE INSLIP	
Match AR4-6 with R4-5 & brush teeth of R4-6	Warner Gear Co. Adjustable Center Distance Speeder
Match 3 pinions with R4-4	Warner Gear Co. Bench Speeder
Over Drive Partial	

(Below) National Broach Red Ring gear finisher is used for the finishing cuts on the overdrive ring gear.





(Above) Well - known Gleason gear shapers are used in Plant 3 for producing ring gear and pinion sets for replacement trade.

(Right) Another view in Plant 3 cylinder head production line showing battery of machines for family of operations. Cincinnati Duplex Hydromatic miller in foreground used to straddle mill both sides. Natco multiple drill in background drills 30 holes.

chine takes two gears at a time. A Heald Gage-Matic is being used for grinding the bores in small gears.

A new acquisition in the automatic department is a 2⅝ in. National Acme Gridley, four-spindle machine. It is provided with the well - known Blanchard Pulsator which assures positive lubrication and reduces maintenance expense.

Since it would be quite beyond the scope of this article to cover every activity in detail, we have selected a number of factory routings on some of the major parts. These routings are complete in every detail including the type of equipment used for each operation. For Plant 1 we have listed the following routings:

Overdrive transmission case
Overdrive Ring Gear
Main Drive Gear
Countershaft Gear
Main Shaft

Truck Transmissions from Plant 2

The second unit is Plant 2 which is set up for the production of truck transmissions. As in the case of Plant 1, this unit is self-contained and produces its own gears, shafts, cases, etc., using the same advanced techniques in the manufacturing process but utilizing equipment more suited to lower volume. A group of photographs has been included in the pictorial section, highspotting some of the operations on a typical truck transmission case.

The following are among the major departments in this plant—heat treat, gear blanking and cutting, automatics, grinding, transmission case machining, transmission assembly, quality control.

Natco boring mills, Cincinnati Hydromatic as well as standard horizontal milling machines, and Aurora drills, constitute the major items of equipment on the truck cases. A Newton rotary mill is used for rough and finish-milling of large faces.

One of the transmissions built for a large truck producer is shipped in color. This is handled on an interesting arrangement of a long endless overhead conveyor chain which drops down through a small spray booth station where color is applied. The endless chain affords ample time for drying, serving as a storage station as well.

The Service Unit

This is the new service unit constructed last year during sub-zero weather in the record time of 28 days. When one sees this large unit seething with activity it is difficult to believe that it has been in operation only a few months and that it could have been erected in so short a time.

The plant comprises two fairly well defined sections—the contract division, and service parts division. Of these, the contract division is set up principally for the production of transmission gears and synchronizer assemblies and parts intended for use in customer's transmissions. The service division makes an amazing variety of service and replacement parts for the jobbing trade. Among these are—cylinder heads for certain popular cars, including Ford, Chevrolet, and Buick; synchronizer units; transmission gears; ring gear sets; differential gears and sets. An outstanding feature of this department is a huge service stores section carrying an inventory estimated around $500,000 of parts of every variety ready for shipment to regional warehouses on a moment's notice.

(Above) All transmission gears for service transmissions are lapped on the National Broach Red Ring lapping machine.

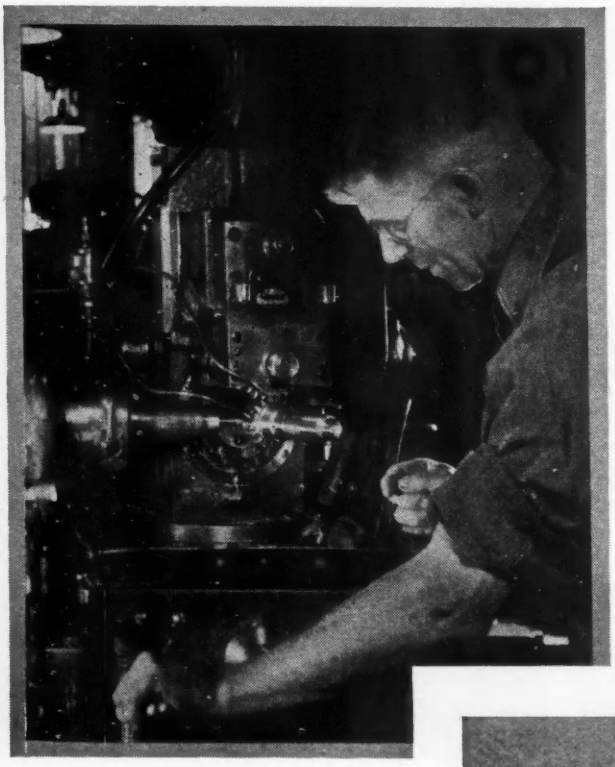
(Left) A complete line of cylinder heads for popular cars is produced for replacement trade in service plant. View shows 24 in. Aurora drill—core drill, counterbore, and face exhaust valve seats.

Among the major manufacturing departments in this plant are the following—

CONTRACT DIVISION—heat treat and annealing, gear blanking, gear cutting and grinding, gear matching, gear quality, automatics.

SERVICE PARTS—bevel gear and pinion, transmission gear blanking, cutting and grinding, cylinder head machining and water test, quality.

An interesting feature of the service plant is the use of small self-contained production lines for the various specialty items. Equipment is generally universal in character permitting the routing of many varieties of similar parts over the same machine. A battery of new Barber-Colman hobbers is used for gear roughing while Fellows shapers are used for finishing. Michigan gear shavers have been installed for finishing a certain percentage of production, taking the work directly from the hobbers.



Cimatool chamfering machine chamfers main drive gear teeth automatically.

National Broach Red Ring gear lappers are used 100 per cent in finishing the transmission gears intended for contract or replacement purposes.

Quality is the predominating note in the service division since its chief stock in trade is a high order of precision, sometimes excelling original standards, coupled with a merchandising set-up which assures quick availability of service parts in every section of the country. Ring gear sets, for example, are produced with the most modern methods current in the automotive industry and on the same kind of equipment as will be found in the primary plants. These sets are matched with painstaking care and assure long service life by virtue of careful metallurgical control as well as the maintenance of close manufacturing tolerances.

This plant, too, features a number of modern vertical broaching machines for producing internal splines on synchronizer rings and gears. In this group are a number of V-52 and V-2, 8-ton American broaching machines.

The pictorial section includes a number of views of gear cutting operations to emphasize the familiar production equipment; also some views of cylinder head production. One of the interesting items of equipment in connection with the latter is the Cincinnati Duplex Hydromatic miller used for milling the sides, top and bottom faces. This is indicative of the modernity pervading the production lines.

Factory Routing on Main Drive Gear

Operation	*Equipment*
Anneal	McCann-Harrison Continuous Annealing Furnace
Brinell test	Brinell testing machine
Rattle	48x42 American Wheelabrator Tumblast Mach.
Center both ends, rough & finish turn chamfer, groove stem complete	Sundstrand Double End Centering Machine 19S Fay Lathe
Drill, bore, recess, ream, co'bore, turn, face, chamfer & center gear end, drain oil, ream, center true with hole	1⅝ Multiple Spindle Acme Automatic
Cut off & recenter steam end	16x8 Monarch Lathe
Green grind large & medium diameters	10x36 Norton Cylindrical Grinding Machine
Inspect	
Block teeth	No. 12 Double Over-Arm Barber Colman Hobbing Machine
Finish cut teeth & drill, burr 2 oil holes	No. 7 Fellows Gear Shaper 1 Spindle High Speed Allen Drilling Machine
Chamfer teeth	Cimatool Chamfering Machine
Cut spline & burr teeth	No. 12 Double Over-Arm Barber Colman Hobbing Machine
Wash	Bench
Burnish teeth, place in basket & push thru wash machine	Crescent Model 1B Washing Machine Bolender Gear Burnishing Machine
Inspect	Crescent Model 1B Washing Machine
Cyanide, quench in oil	Cyanide Furnace
Wash, draw in oil & wash	Crescent Model 1B Washing Machine Electric Oil Drawing Furnace Wash Bbl.
Rockwell test	Rockwell testing machine
Clean center	Electric Motor
Straighten if nec.	Hand straightening press
Inspect spline for size	
Sandblast spline to size if nec.	No. 24 Pangborn Sandblast Machine
Grind center	No. 75A Heald Internal Grinding Machine
Indicate	Brown & Sharpe Indicating Fixture
Grind large diameter	10x36 Norton Cylindrical Grinding Mach.
Grind pilot diameter	10x36 Norton Cylindrical Grinding Mach.
Grind medium & spline diameter	10x36 Norton Cylindrical Grinding Mach.
Grind hole, push thru wash machine	No. 72A Heald Sizematic Grinding Machine
Inspect and MAKE INSLIP Gear Matching	Crescent Model 1B Washing Machine

Efficiency and Low Overhead

The foregoing is frankly an attempt to high-spot the activity in a manufacturing plant which could not be adequately covered in a presentation many times the length of this article. However, we have made a careful selection of illustrations so as to afford some idea of the philosophy of the factory management and its progressiveness.

It is difficult to convey a fair impression of the intensity with which the floor space has been pressed into productive use. But it is evident to any observer that a high level of efficiency and low overhead burden have been successfully achieved. These management elements coupled with the use of modern equipment are responsible for the company's ability to compete on a profitable basis with any plant in the industry making similar products.

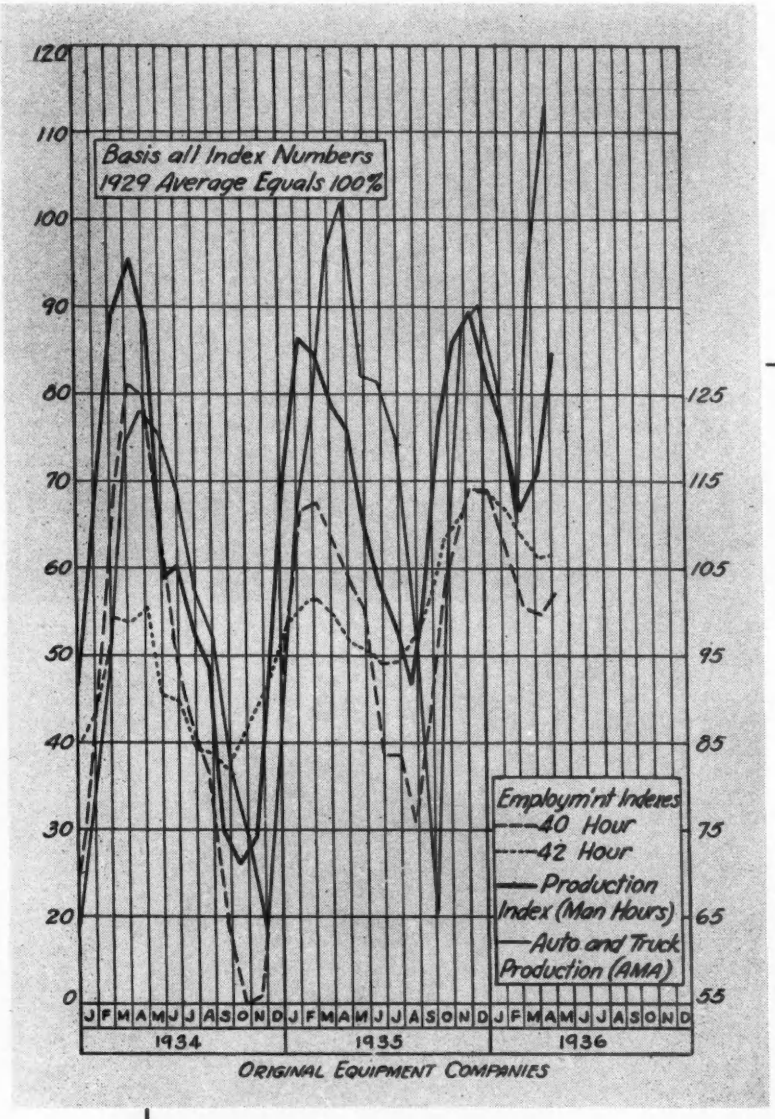
(Top) Grinding center in large end bore of main drive gear on 75A Heald internal grinder.

(Lower right) Bolender burnisher is used for burnishing main drive shaft gear teeth in both directions.

(Lower left) Rough main drive shaft forgings handled on this battery. Sundstrand double-end machine in foreground is used for centering both ends simultaneously. In background is a 19S Fay automatic lathe for rough and finish turning, chamfering, and grooving stem completely.

Study Shows November Automobile

By Clarence O. Skinner*



ENOUGH of the 1935-36 motor-vehicle production season is behind us so that we can study the effect of setting ahead the announcement date of new models. This occurred in January of 1935 and previous years but, for the 1935-36 season, was set ahead to November, 1935.

Referring to Chart 1, the curves of

*Executive Secretary, Automotive Parts and Equipment Mfrs., Inc.

Chart 1

The light solid line represents the index of production of automobiles and trucks in the United States and Canada. These data are obtained from the Automobile Manufacturers' Association.

The heavy solid line represents the index of manhours worked by the original equipment parts manufacturers.

The dash line represents the index number of employment of 40-hour, or production, employees by the original equipment parts manufacturers.

The dotted line represents the index number of employment of the 42-hour employees by the original equipment parts manufacturers.

The heavy solid line (manhours) goes up ahead of the black line (automobile and truck production) and declines ahead of the light solid line up until the four-week period ending April 4, 1936, at which point it breaks sharply ahead of the manhour line. This is a normal procedure since parts must be produced and shipped to the automobile manufacturers prior to the manufacture of the automobiles.

The sharp break upward of the light solid line, ahead of the manhour line of parts manufacture in April of 1936, represents the using up of the relative'y large banks of parts established by the automobile manufacturers in the fall of 1935 at the start of the production season. It is probable that the A.P.E.M. production index will again assume its position ahead of the A.M.A. production index in the next few months.

Employment, as shown by the dash line, reached a peak in the spring of 1934, which has not been approached since that time. This peak of 126.5 was a result of the manufacturers in the Original Equipment field endeavoring to keep their maximum week'y hours per employee down to 40 rather than allowing the employees to work the maximum of 48 hours allowed under the Code and averaging down to 40.

Comparison of First Thirty-six Weeks of the Production Season of 1933-34—1934-35—1935-36

	1933-34	1934-35	1935-36
Average hours per week per employee.....	34.0	35.1	37.1
Aver. employment (40-hour emp.)*	89.1	94.0	103.9
Aver. employment (42-hour emp.)*	91.8	96.5	108.8
Production (manhours)*	65.4	66.4	77.0
Average weekly wage .....$	20.52	$23.50	$25.55

*Index numbers: 1929 average equals 100%.

Comparing the first 36 weeks of the 1933-34 production season with a similar period of the 1935-36 production season, we find that, while the average production, as measured by manhours, has increased 17.7 per cent and the average emp'oyment has increased 17 per cent, the average weekly wage per employee has increased 24.5 per cent.

Particular attention is called to the fact that, in the 1935-36 production season, this group is employing more employees than in 1929.

Exhibits Smooth Equipment Curves

automobile and truck production of the automobile manufacturers and manhours and employment of the parts manufacturers for 1934 are typical of the curves for the years 1929, 1930, 1931, 1932 and 1933, when the announcement date came in January. During these years the peak occurred either in March or April of each year and the extreme low point was reached usually in October. Employment and manhours remained relatively low during November, December and January.

The 1934-35 production season, with the announcement in January, started out to repeat the history of the preceding years. However, with the preparation for the announcement of 1936 models in November, 1935, the 42-hr. employment curve turned up in July whereas, in the past, this change had occurred usually during October.

The manhour curve and the 40-hr. employment curve turned up in late August and early September whereas, in the past, this change had occurred in late October and November.

The peak in production, manhours and employment was reached in December and January whereas, in the past, the peak had occurred in March or April. This peak was followed by declines in late January, February and March.

Another peak is developing in the April-May and June period and it is probable that the low point for manhours and production of the parts manufacturers will again be reached in August of 1936. It is also to be noted that the low point in employment and manhours, which was reached in 1934 and the preceding years, was not reached in 1935 and that, whereas the differences between the high and low points in employment in the 1934-35 production season amounted to 58, this difference so far in the 1935-36 season, has amounted to only 38. Approximately the same proportions are true of manhours.

Therefore, while it is yet too early to know the final effect of the change in the announcement date upon production and earnings in the parts industry, nevertheless it is apparent that this change has resulted in

1. The leveling out of employment in the parts industry and, although the peak of employment is not as great as in the past, employment is more uniform than in past years and greater than in 1929.
2. Manhours have followed the same leveling out process as employment and consequently the individual employee's earnings for the year are greater and his employment is steadier.
3. The low point in employment and manhours has been shifted ahead to the summer months and the high point to the winter months. Thus the situation has been reversed and the employee's earnings are now least when there is the least demand upon his pocketbook and greatest when the demand is greatest.

Rate Per Hour Has Increased Steadily

Chart 2 shows the earnings per week, the earnings per year, the average hours per week per 40-hr. employee and the average rate per hour per factory employee.

The curve at the bottom of the chart shows the average rate per hour per factory employee. This has steadily increased since the fall of 1933 and reached its highest point of 68c. for the four-week period ending May 2, 1936. This rate is the average for all factory employees and includes both male and female.

The curve in the middle of this chart represents the average hours per week worked by the 40-hr. employees, male and female combined. This curve in 1935 and 1936 shows the results of the efforts made by employers in this industry to give their employees more hours per week and thus increase their individual earnings. Also in October, November and December of 1935 it

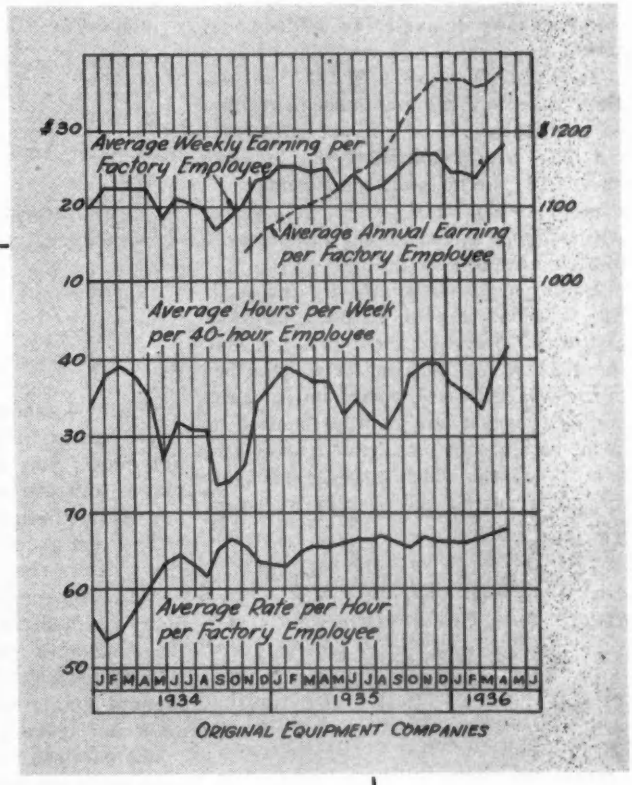


Chart 2

Weekly and annual earnings, average hours per week for 40-hr. employees and average rate per hour for factory employees in original equipment plants members of the A.P.E.M. The companies whose reports are conso'idated in this chart have more than 90 per cent of their production in the original equipment field.

shows the effect of the setting ahead of the announcement date of the new models.

The curves at the top of the chart show the earnings per week and the annual earnings of all of the factory employees in this industry. These curves are, of course, a function of the two curves at the bottom of the page. The dotted line represents the *average* annual earnings of all factory employees including male and female and starts with an earning of $1,036 for the year ending in November of 1934 and shows a consistent increase, with a peak of $1,280 reached for the year ending May 2, 1936.

Manhour Cycle Broke in 1935

In 1935 the manhour curve (Chart 3) started out to repeat the cycle of 1934 and is comparable for the first six months. However, for the last six months, the curve shows an increase rather than a decrease as in past years. After discussing this with several representative replacement parts manufacturers, we have come to the conclusion that this increase in the last six months of 1935 is a result of the setting ahead of the announcement date of new models (January to November) by the automobile manufacturers. A sales peak of new automobiles, not experienced in the past, was developed in the fall of 1935. As a result, there was a comparable peak in automobiles to be reconditioned for resale and consequently an increased demand for replacement parts.

It is therefore probable that the setting ahead of the announcement date of new automobiles will not only level out the production and employment curves for the original equipment manufacturers but this same leveling out will be experienced by the replacement parts manufacturers.

Employment, as shown by the dash line, reached a peak in June of 1934 and the 1935 cycle started out to repeat the 1934 cycle, the first six months being comparable. However, as in manhours, the last six months showed a large increase in employment over the first six months which increase has been continued during the first 22 weeks of 1936.

COMPARISON OF FIRST TWENTY-TWO WEEKS OF 1934, 1935, AND 1936

	1934	1935	1936
Average hours per week per employee	36.6	37.5	39.2
Aver. employment (40-hr. employee)*	103.3	101.8	113.0
Aver. employment (42-hr. employee)*	81.0	99.5	117.0
Production (manhours)*	97.9	99.0	115.0
Average weekly wage	$18.23	$20.56	$21.53

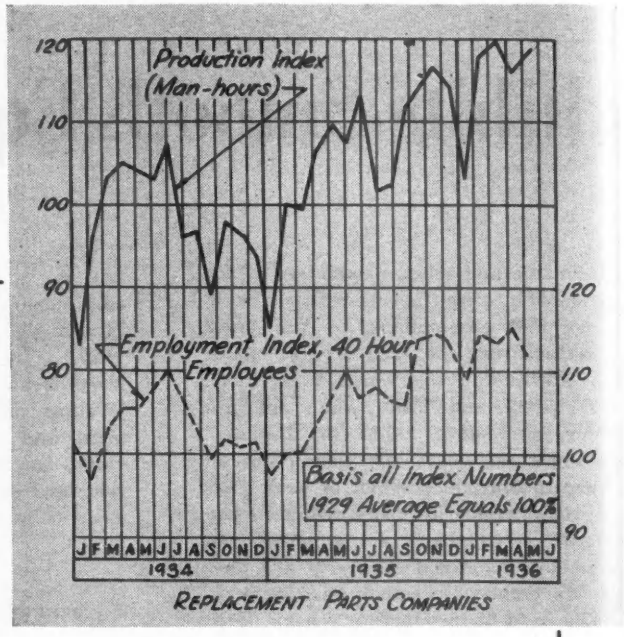

Production Index (Man-hours)
Employment Index, 40 Hour Employees
Basis all Index Numbers 1929 Average Equals 100%
120
110
100
90
80
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
1934
1935
1936
REPLACEMENT PARTS COMPANIES

Chart 3

The solid line represents the index of manhours worked by the replacement-parts manufacturers.

The dash line represents the index of employment of 40-hour (production) employees employed by the replacement parts manufacturers.

The solid line (manhours) for 1934 represents a typical production curve for rep'acement parts manufacturers prior to 1935 with a general high production during the first six months and a lower production during the latter six months. That this curve is approximately the same as the sales curve of replacement parts is shown by comparison with the dash line shown on Chart 5 for 1934.

* Index number: Report for four-week period ending Feb. 9, 1935, used as 100 per cent.

Comparing the first 22 weeks of 1936 with the first 22 weeks of 1934, we find that while the average production, as measured by manhours, has increased 17.5 per cent and the average employment has increased 12.4 per cent, the average weekly wage per employee has increased 18.1 per cent.

Rate Per Hour Peaked in April

Chart 4 shows the earnings per week, the earnings per year, the average hours per week per 40-hour employee and the average rate per hour per factory employee.

The curve at the bottom of the chart shows the average rate per hour per factory employee. This rate per hour reached its peak of 55½c. for the four-week period ending April 4, 1936. This rate is the average for all factory employees and includes both male and female.

The curve in the middle of this chart represents the average hours per week worked by the 40-hour employees, male and female combined. By comparing this curve with the same curve for the original equipment employees, as shown on Chart 2, the more uniform employment of the replacement parts manufacturers can be easily seen.

The curves at the top of Chart 4 show the earnings per week and the annual earnings of all of the factory employees in the replacement parts group. These curves are, of course, a function of the two curves at the bottom of the page. The dotted line represents the average annual earning of all employees, including male and female, and starts with an annual earn-

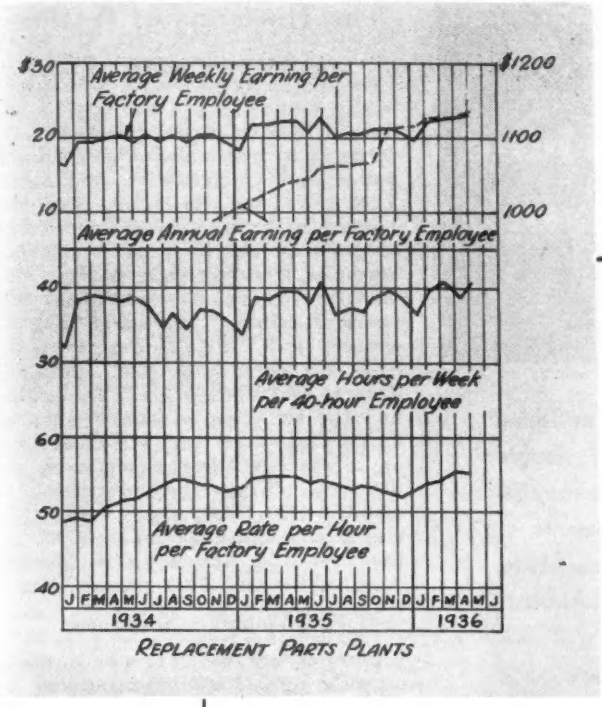


Chart 4

Weekly and annual earnings, average hours per week of 40-hr. employees and average rate per hour per factory employee in replacement-parts plants whose production is 90 per cent or more for the replacement-parts market.

ing of $985 for the year ending in November of 1934 and shows a consistent increase with a peak of $1135 for the year ending May 2, 1936.

Tax Payments Show Volume

Starting with June 21, 1932, all replacement parts and accessories sold, carried an excise tax of 2 per cent. This includes the replacement parts and accessories sold by the car manufacturers as well as those sold by the parts manufacturers.

We have obtained from the Department of Internal Revenue, the monthly collections of this excise tax and these monthly collections are shown by the dash line on Chart 5. The amount shown as the collection for any given month on this chart, represents 2 per cent of the sales volume of automotive parts and accessories for the preceding months, as reported to the Collector of Internal Revenue.

This dash line is fairly comparable to the curve of production (solid line) for replacement parts, shown on Chart 3 for the year 1934. However, on months that end on week-ends, there is an apparent error in reporting collections and, as several months in 1935 ended in this way, we have a very large "sawtooth" development in the dash line during that year. When this occurs, it is apparent that sales for more than one month are reported in that period.

In order to make Chart 5 of particular value to every manufacturer in this industry who sells replacement parts or accessories, we have plotted the solid line, which is a twelve-month running average and which eliminates the seasonal fluctuation and shows the trend of the replacement parts and accessory sales volume. Any point on this solid line represents 2 per cent of the average monthly sales volume for the year starting six months ahead and ending six months after that date.

This solid line is important, for it shows the trend of the combined parts and accessories sales of both the replacement parts manufacturer and the car manufacturer. By plotting your monthly sales in dollars and determining the trend line for your own business by setting up a curve of the twelve-month running average, you can determine whether or not your replacement parts sales are keeping up with, going ahead, or falling below the trend of the total sales for all manufacturers.

For the first four months of 1936, the sales volume of replacement parts and accessories, as reported by the Collector of Internal Revenue, has increased approximately five and three-quarter millions of dollars over the sales volume for the same period of 1935.

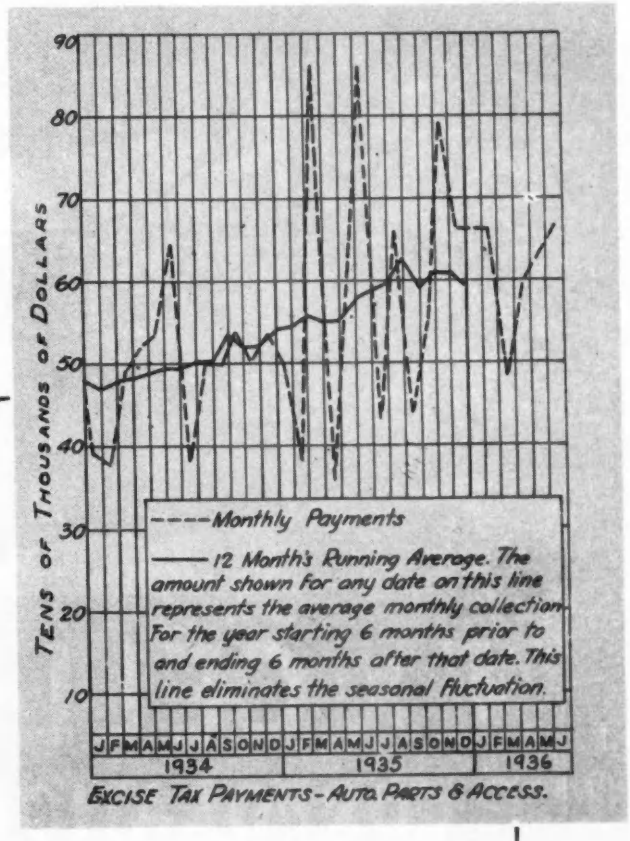

90
80
70
60
50
40
30
20
10
TENS OF THOUSANDS OF DOLLARS
----Monthly Payments
——12 Month's Running Average. The amount shown for any date on this line represents the average monthly collection for the year starting 6 months prior to and ending 6 months after that date. This line eliminates the seasonal fluctuation.
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
1934
1935
1936
EXCISE TAX PAYMENTS - AUTO. PARTS & ACCESS.

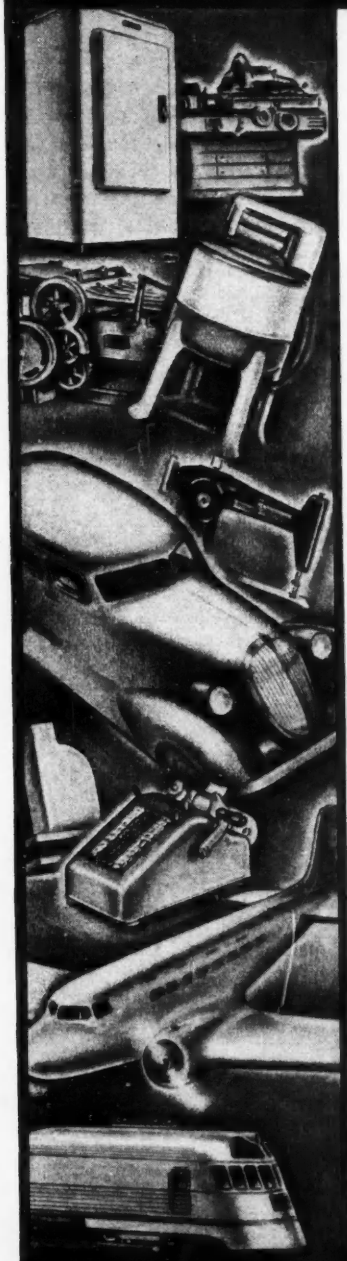
Chart 5

Monthly collections of excise tax on replacement-parts volume of car manufacturers and replacement-parts manufacturers, representing 2 per cent of the dollar volume of these plants, plotted against a 12-months' moving average to eliminate seasonal fluctuations.

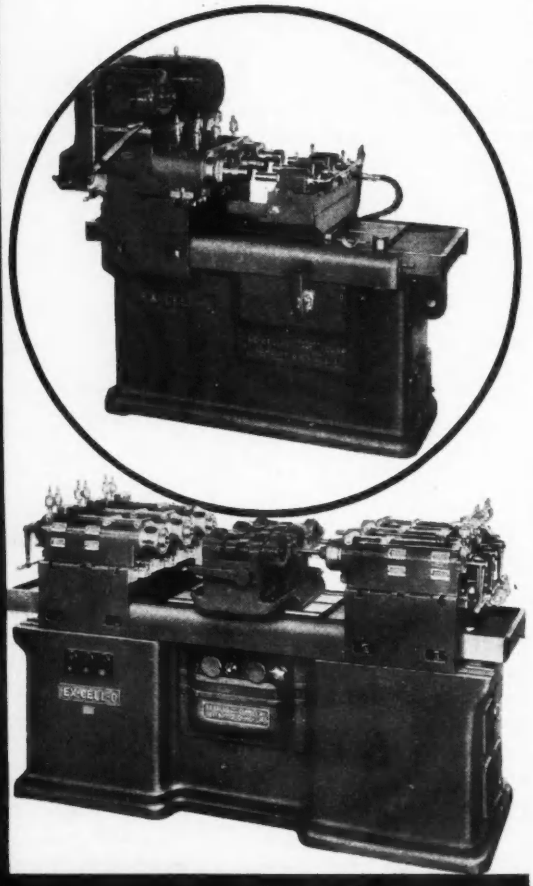
There is an

XLO Precision Boring Machine

to meet Production Requirements of Every Industry



5 sizes of XLO Precision Boring Machines (single and double end) provide a machine specifically suited to the requirements of boring, turning, and facing operations. The "Senior" Series is illustrated. Complete information will be furnished upon request.



EX-CELL-O

AIRCRAFT & TOOL **CORPORATION** DETROIT, MICHIGAN

The Horizons of Business

(Continued from page 136)

tion. Through many generations the farmer has reconciled himself to the unpredictable treatment of nature. Years of bountiful crops are interspersed with years of failures. Averages are struck by decades and generations. If the drought parched their fields, if parasites consumed their crops, if bumper harvests in the Argentine or the Antipodes depressed the price of wheat and wool the consequences would be deplored. The anguish and the wringing of hands were due to an impersonal fate which could be appeased only through piety. It was impossible to sue the boll weevil, demand a judgment against the cinch bug or claim satisfaction from the fertile acres of Russia, whose bumper crop had depressed the price of wheat.

A Voluntary Scapegoat

Previous governments whose wisdom we now appreciate commiserated the farmer and sought in many ways to help him combat adversity. They always had the good sense to stop short of attempting to compensate the whims of weather and market. It was not that they loved the farmer less than the present Administration but only that they would not attempt the foolhardy or the impossible.

Consider the predicament of our government today. It has voluntarily assumed the responsibility of controlling the production of farm commodities, their prices and the share of the national income which goes to the farmer. Since this role of paternalistic benefactor has been thoroughly advertised the farmer, when touched by hard luck, refuses to stop at the Creator. He refuses to vent his indignation at anything so impersonal as a drought, a high wind or a marauding pest. Not while human, feeling victims are available to slake his wrath. Uncle Sam has promised to maintain his purchasing power, the disfavor of elements and the markets to the contrary notwithstanding. That Uncle Sam had no business in the first place to make any such commitments is not the concern of the farmer.

Importation of Food

This has resulted in the well known bull-by-the-tail situation whose full gravity is not yet appreciated. The Department of Agriculture, supported by Harry Hopkins, still goes about its task with some of the honeymoon enthusiasm that prevailed in all departments during the early months of the New Deal. However, some difficulties are already apparent. One of these is the disconcerting increase in the imports of farm commodities. Secretary Wallace has made an elaborate analysis tending to prove that the relation of imported farm commodities to the total value of farm production is less today than it was in the pre-New Deal

era. Agencies of the government which have in the past been able to avoid campaign polemics have lined up with Mr. Wallace. The Bureau of Agricultural Economics, whose work has always been highly regarded by students of agriculture, comes to the support of Mr. Wallace. However the charge has been made and circulated. It (i.e., that crop restriction has so far reduced production as to necessitate imports and the supporting figures) is much easier to grasp than the refutation. As a campaign document the Wallace rebuttal is a foul ball.

Selective Propaganda

Another difficulty which is proving even more refractory is the effect of drought plus regulation upon farm output and then upon farm prices. This is a many edged sword. The heralds of the Department of Agriculture would like to tell the farmer that his cash income, by virtue of higher unit prices, will be no less this year than it was in 1935. Such a statement cannot be confined to the ears of those who are supposed to benefit. It gets to housewives who find that their market basket is less easy to fill. It gets to farmers who not only do not profit by the rise in prices but are victimized by it.

The Dairy Farmer

Dairy farming is an unsung major industry. It provides more jobs and produces more income than the steel and automobile industries combined. It accounts for more than one-fifth of agriculture's total income. Now the dairy farmer's greatest cost item is feed, most of which is raised by other farmers or is the by-product of crops which other farmers produce. Among the more common feeds are bran, a flour milling by-product, gluten, a corn processing by-product, cotton seed meal which speaks for itself, etc. Within 30 days the price of bran in the New York market rose from $22.00 a ton to $35.00. The cost of common dairy rations have gone up from 30 to 50 per cent.

Rushing relief to an area, Montana and the Dakotas, which would never have been cultivated in the first instance had not an excessively generous government through its newly established land banks extended credit, may secure some votes. On the other hand it will further provoke those dairy farmers who have already experienced the effects of W.P.A. and relief competition in their labor markets.

The Housewife

The average housewife may not be a profound economist. She does know that a cut in the supply tends to raise the price. Since it is the farmer's supply which is cut and her costs which are raised, she recognizes cause and effect. She also knows that the government has paid the farmers generously for not producing wheat, bacon, sugar and sundry other items which she must buy with her weekly allowance. She could hardly escape the conclusion that Uncle Sam is responsible for her diminished purchasing power. The drought may be partly to blame but well meaning (?) Uncle had no business making it worse.

To explain how the A.A.A., now the S.C.A., has raised the purchasing power of one group of farmers, while the drought is entirely responsible for the mounting costs of dairy feed and the higher price of food calls for an adroitness which even the rich resources of the English language do not permit. It may eventually appear again, as it did so convincingly to our ancestors a hundred and fifty years ago, that the best government is that which governs least.

Automotive Metal Markets

(Continued from page 139)

Copper—Some business is reported to have been done on the new 9¾-cent basis, which is remarkable because all of the fabricators stocked up heavily before the advance.

Tin—On reports that the Siamese government had rejected proposals of the International Tin Committee as a basis for renewal of output restriction agreements, the market broke sharply. At the close of last week, 44 cents was asked for spot Straits. At the opening of the market on Monday of this week, offers at 42 cents were turned down.

Examine a universal joint. If its component parts are machined all over, the joint is probably in perfect balance—and probably a "Mechanics". Castings and forgings have small irregularities which create an out-of-balance condition unless corrected. All parts in Mechanics Universal Joints having any appreciable effect on balance are machined all over thus insuring smooth running and long life. These joints are used in leading cars, trucks, busses. Investigate. Write today for complete information.

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Willys Reorganization Plans

(*Continued from page 133*)

Under the plan for reorganization, all old stockholders, bondholders, creditors and other claim holders will be given certain rights to subscribe to stock in the new company with a view to regaining their equities. For purpose of exchange and subscription, the new Willys-Overland Motors, Inc., shares have been grouped into units of one share of preferred and one share of common, valued at $10 per unit for purposes of calculation. Holders of bonds will be given 70 units or 210 shares of common for each $1000 bond with coupons attached. In payment of mechanics' liens seven units, or 21 shares of common stock, will be given for each $100 due. Holders of general unsecured claims not owned by Empire Securities, Inc., will be issued 25 units, or 75 shares of common for each $1000 of claim. Such exchanges will be made by Empire Securities, Inc., and it in turn will put $10 in cash into the new company for each unit so exchanged.

Subscription rights will also be issued to bondholders at the rate of 50 units for each $500 of bond at $10 per unit. Creditors of the old company and of Willys-Overland, Inc., a sales subsidiary, excepting Empire Securities, shall be entitled to subscribe to three units for each $100 of claim at $10 per unit. Holders of preferred stock in the old company may subscribe for two units for each share of the old stock. Holders of old common may subscribe for one unit for each 10 shares of the old stock held. City Bank Farmers' Trust Co., New York, will receive the subscriptions and remittances. Rights may be exercised up to 35 days after confirmation by the court or the time may be extended under certain conditions.

The preferred stock is convertible and prior to Dec. 31, 1938, one share of preferred may be converted into two of common; prior to Dec. 31, 1941, into 1½ shares of common; prior to Dec. 31, 1946, into 1¼ shares of common; or prior to Dec. 31, 1951, into one share of common.

Sinking fund arrangements for redemption of preferred stock are also set up so that 25 per cent of earnings may go to redeem outstanding preferred after May 1, 1939.

A new corporation, Willys Properties, Inc., capital 2000 shares no par common stock, has been formed to acquire Willys-Overland Branches, Inc., and properties not used by the new company and to extinguish debts of the trustee.

West Brothers, Inc., appraisers, directed by Federal court, recently valued the properties at $219,236 for land, $4,756,427 for buildings, and $4,980,195 for equipment as a going concern. Such of the property as is security for the mortgage lien valued for disposal in 18 months is appraised at $1,552,095 and is subject to a lien of $704,988 plus current taxes due for 1936, estimated at about $90,000.

From liquidation of equipment and affiliated companies $1,200,037 is held by the trustee in a separate fund. To the mortgage trustee $500,000 has been advanced out of which $73,735 has been paid out as expenses. There has been a dispute as to what portion of the fund from liquidation could be obtained by bondholders and what might go to general creditors. To settle the litigation might take several years of legal maneuvering.

The trustee had $561,371 cash as of April 3 and liabilities of $888,465. It is estimated costs of committee's and attorney's fees in the receivership and receivers' compensation would aggregate $500,000. It is shown that liquidation would yield no equity for preferred or common stockholders and that the amount of debt would greatly outweigh probable liquidation value of the company.

The pro forma balance sheet set up for the new company, with many items subject to change, uses the going concern values of the West Brothers, Inc., appraisal for the property—$219,235 for land, $4,756,427 for buildings and $4,980,195 for equipment.

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MANY a perfect safety record has been shattered by Oil Dermatitis. Carried from worker to worker by cutting lubricants infected during use, this serious skin disease cripples production... causes compensation payments. Guard your men against infection by using Derma-San. Just add 1 pint of Derma-San to 35 gals. of cutting lubricant, and kill dangerous pus-forming germs before they attack your workers.
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Investments in subsidiaries are Willys Export Corp., handling foreign sales, $133,539; Willys-Overland Pacific Co., operating assembly and sales on Pacific Coast, $1,112,858, and Willys-Overland Parts Corp., at $199,080. Together with $75,000 of nonproductive inventory and the $3,500,000 of new cash, this would give the new company total assets in the tentative set-up of $14,976,336.

Disposition of the common stock is outlined as 350,000 shares to be issued in units with preferred shares, 1,500,000 shares in payment of assets acquired, 150,000 shares reserved for sale to executives and employees, 700,000 shares reserved for conversion of preferred stock and 150,000 shares for compensation to underwriters.

Sanderson & Porter, industrial engineers, who made an economic study under direction of the court, recommended that Wilson Foundry & Machine Co., Pontiac, Mich., subsidiary, be left as an independent unit.

The plan has been received with considerable enthusiasm by city officials and citizens of Toledo and is expected, if consummated, to aid materially in solving employment problems in that city.

Motor Earnings Soar

(Continued from page 134)

redemption of the Dodge Bros. 6s over a year ago. This completes a $40,000,000 operation, of which the major part was undertaken in the early spring of 1935. The company anticipated the 1938 and 1939 maturities and paid off all the loans.

Dollar sales for the half year were $358,634,899 against $295,569,895 last year. Unit sales were 578,407 against 487,157 last year.

Balance sheet showed cash of $67,696,659 after the loan payment, security holdings of $14,604,488, B/L drafts of $8,008,168, trade receivables of $10,553,401 and inventories of $30,723,450. Cash and securities were much larger than on Dec. 31, 1935, and inventories were lower.

The income statement showed depreciation charges of $7,583,724 against $13,656,520 last year and against $7,717,145 in 1935. The difference is due to a change in bookkeeping methods and is expected only to alter the charges as between quarters but not to reduce the charges over an entire year.

Net income of the Studebaker Corp. for the June quarter was $900,174 or 41 cents a share against a net loss for the 1935 period of $119,510. For the half year the net income was $1,004,829 or .47 cents a share. Sales for the quarter were 26,394 units and parts valued at $19,422,067 against 15,831 units valued at $12,012,778 last year. The balance sheet showed current assets of $13,826,897, including cash of $8,375,618 and current liabilities of $4,503,191.

White Motor Co. reported for the half year a net profit of $287,421, the first profit it has shown since the mid-year statement in 1930. It compared with a net loss of $851,573 for the first six months last year. The profit was after all normal charges except possible income taxes. The showing is equal to 45 cents a share on the company's 625,000 shares of common stock, its only capital issue.

"The profit," R. F. Black, president, said, "was made on sales of $13,775,740, which was an increase of 51.1 per cent over the sales for the same period last year, while unit sales of the company amounted to 5349, a gain of 83 per cent and within 1471 trucks of the total for the entire year 1935."

The White financial position showed improvement along with the gain in business and profits. The balance sheet which was issued as of June 30, showed cash on hand of $1,470,126, while current assets were $16,975,407 and current liabilities only $4,577,152, which gave the company working capital of $12,398,255, a gain of $766,511 over the amount the company had at the end of 1935, which was the time of the last financial statement.

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Kay-Brunner Making House Trailer Axles

Axles for house trailers are being manufactured by Kay-Brunner Steel Products, Inc., Los Angeles, Calif. The ends of these axles are made of heat-treated steel castings (S.A.E. 4640) while the center is a Shelby steel tube. The same size bearings are used at the inner and outer ends of the spindles. The hubs and brake drums, which come with these axles, are cast in one piece. The tread is varied to suit the particular design of house trailer. Bendix brakes, 11 by 1¾ in. in dimension, with cable control, are provided.

British Buses Make Tests of Compressed Coal Gas as Fuel

Experiments in running motor buses by compressed coal gas instead of petrol are being carried out on Merseyside by the Wallasey Corp., and are being watched with interest by other transport authorities throughout Great Britain. The gas is carried in two steel cylinders beneath the bus, and, compared with petrol at an average cost of 1s. 1d. per gal., the compressor works out at seven pence. If exhaustive tests prove satisfactory, as they have so far, a large number of buses are to be converted.

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"**Production Highlights**"* is the name of a new monthly bulletin introduced by the Michigan Tool Co., Detroit. Notable for its brevity, the bulletin is printed on one side only and contains new product descriptions, new uses for equipment and brief notes of general interest to production men.

A well illustrated non-technical catalog has just been issued by Leeds & Northrup Co., Philadelphia. The full line of the company's "**Micromax Thermocouple Pyrometers**" including a brand new model are set forth with complete comparative data.

Listing over 4000 parts in the company's full line of bearing replacements, the 1936 **Federal-Mogul Catalog*** has recently been distributed. Standard and undersize bearing of every type and for every use are included.

A recently issued 16-page catalog No. 1101B,* details features of the **TAG Indicating, Recording and Controlling Pyrometers** manufactured by C. J. Tagliabue Mfg. Co., Brooklyn, New York. A beam of light, a mirrow galvanometer and a photo-tube are employed in this type instrument.

There's little that's left unsaid about steel, in the 192-page **General Data Book*** recently issued by Joseph T. Ryerson & Son, Inc. Nevertheless there are 15 supplementary booklets listed in the back covering special steels. A copy of this general data book should be a valuable asset to any steel man.

Available through AUTOMOTIVE INDUSTRIES

British Railcar Runs on 16 Rubber-Tired Wheels

The first British-built pneumatic-tired railcars are being tried out on the London Midland and Scottish Railway. In the early part of last year a railcar of this type was brought over from France and tested, but the Coventry-built cars differ in that they are faster and more powerful.

Each car is carried on 16 pneumatic-tired wheels, accommodates 56 passengers seated, and has a cruising speed of 60 m.p.h. with a maximum of about 75 m.p.h. Cars are driven by a 275 hp. petrol engine with self-changing gear box, and can run with equal facility in either direction.

Packard to Sponsor Astaire On Series of NBC Programs

The Packard Motor Car Co. has announced that it will sponsor Fred Astaire in a series of weekly full-hour broadcasts starting in September. Astaire on a Packard program will give him his first long-term radio series and Packard a popular entertainer with diversified talents as a singer, actor, instrumentalist and light comedian. For the past two seasons Packard sponsored Lawrence Tibbett's broadcasts. Fred Astaire will be the central figure of a carefully planned production which will be given over the N.B.C. red network, Tuesdays from 9:30 to 10:30 p.m., Eastern time.